Give

enough!

OCTOBER
1950

POWER

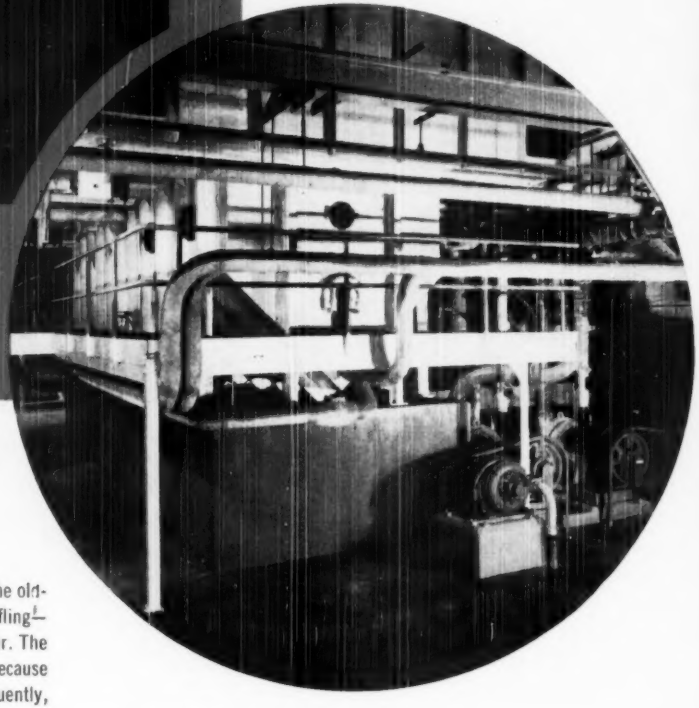
A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

SUNBURY: GEARED TO BURN MIXED COALS, p 74

CONTENTS, p 69

A typical old-fashioned ash basement. Note spilled ashes and water on floor, flying dust and radiant heat. Also the lance used for prying loose stubborn clinkers.

Here, a typical modern Hydrojet installation.



ASH handling used to be

the worst job in the plant

Nobody envied the crew "sweating it out" in the old-fashioned ash basement. The air was hot and stifling—full of dust, coal gas, steam and dripping water. The ash-removal crew had a thankless job, too, because their methods were inefficient and, consequently, expensive.

Contrast this with the modern Hydrojet method of ash handling. The ash basement now has the same clean look as the turbine room. All of the hazards have been removed; the ashes and dust never see the light from the time they leave the furnace until they reach the point of disposal. The grimy, unhappy men have gone, and the man who "handles" the ashes spends only a short time each day at this job. In a recirculating system, the water that does the work is recovered at the end of the process and is used time after time. There is no water waste, no stream pollution. Our nearest representative will be glad to tell you how Hydrojet can be adapted to your particular set-up.

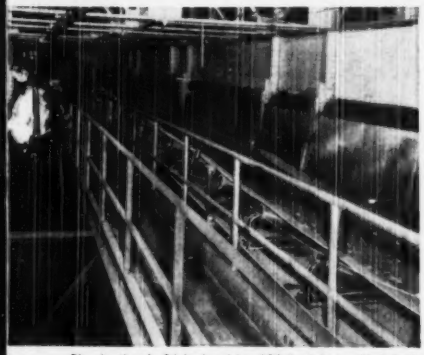
HYDROJET ash handling system

ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. *Offices & Representatives in Principal Cities*

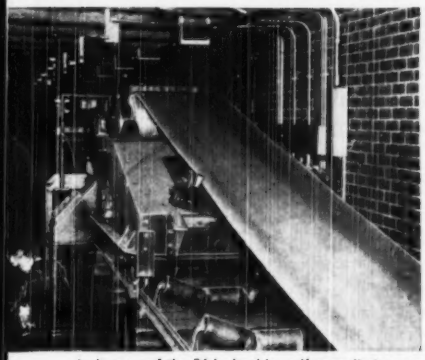
POWER (with which are consolidated "Science and Industry," "The Engineer Review," "Tee Engineer," "The Stationary Engineer") October, 1950, Vol. 94, No. 10. Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Editorial and executive offices, 330 W. 42nd St., New York 18, N. Y. Entered as second class matter January 26, 1949, at the post office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least 10 days for change of address. Subscription rates, U. S. and U. S. possessions, $5 for one year, $7 for two years, 65c per single copy. Canada $7 for one year, $11 for two years. Pan American Countries, $10 for one year, $16 for two years. All countries $13 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.

Enlarged Generating Station Speeds Coal Handling with LINK-BELT Equipment

General view of the expanded Barbadoes Station of Philadelphia Electric Company, near Norristown, Pa. showing inclined gallery for the 415-foot Link-Belt Belt Conveyor from breaker to power house. Car-unloading house is at right.



The inclined, 36-inch wide, 190-foot long, Link-Belt Belt Conveyor over the old bunker.



A close-up of the 36-inch wide, self propelled, manually operated belt tripper that distributes the coal throughout the length of new bunker.

350 Tons an hour
from Track Hopper to Bunker *with Minimum Attention*

Coal is received at this station in hopper cars from which it is unloaded by vibratory shaker to track dump hoppers, then to steel apron feeders and transferred at a uniform rate to a central collecting belt conveyor. A steel flight conveyor-elevator delivers the coal up to the breaker in the conveyor junction house. A motor-operated flap gate in a two-way chute under the breaker hopper discharges the coal either to the belt feeder or to a collecting hopper. The feeder belt conveyor delivers the coal to an inclined, 415-foot belt conveyor to the power house, thence by two belt conveyors over the old bunker to the horizontal 180-foot conveyor that extends the length of the new coal bunker. A self-propelled, manually operated belt tripper distributes the coal throughout the length of this bunker.

When the coal bunker is filled, the hopper under the breaker is used for filling a 12-ton capacity Carryall that transfers the coal to the storage yard. This Carryall is used also for reclaiming coal to the track dump hopper when it is necessary to use coal from the reserve storage.

Any expansion program offers a good opportunity to review the over-all coal-handling problem. It will pay you to consult Link-Belt on your coal-handling method. Link-Belt engineers and builds complete coal-handling installations to meet specific conditions in public utility and industrial power plants.

12,188

LINK-BELT

COAL and ASHES HANDLING EQUIPMENT

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in Principal Cities.

LOOK what's here!

NOW the popular B&W Integral-Furnace Boiler design available in a cost-saving shop-assembled unit

Now, for the first time . . . all the inherent advantages of "packaged" boilers, *plus* the traditional economies of B&W's Integral-Furnace construction, are combined in a new factory-assembled water-tube unit. It's the B&W Integral-Furnace Boiler, Type FM—delivered fully equipped for immediate operation.

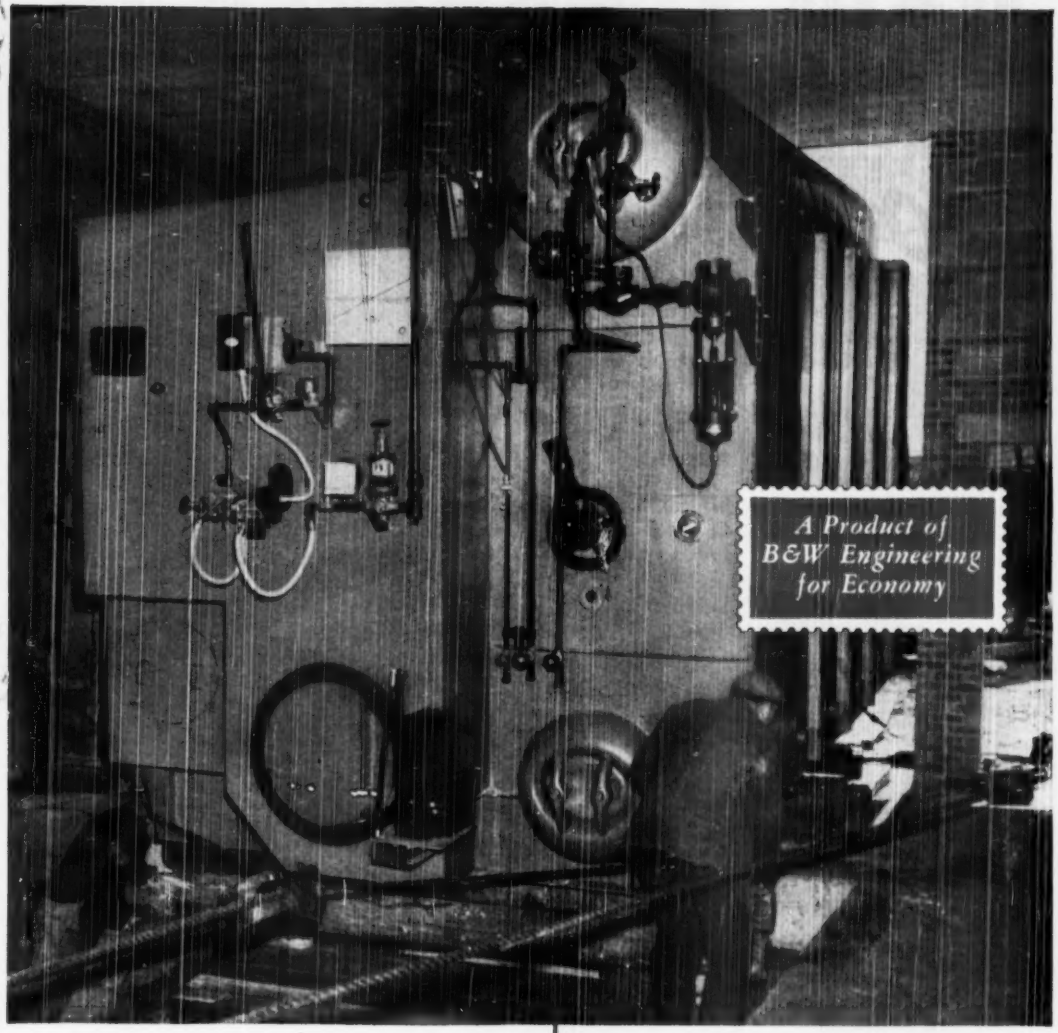
A modern development of the original B&W Integral-Furnace Boiler, this new unit embodies the experience gained through engineering and building over 100 million pounds per hour of installed steam capacity to the same basic design.

Small and medium size plants, institutional and commercial establishments will find in this unit all the answers to low-cost heating and process steam-generating requirements from 3,000 to 35,000 lb. per hr. at pressures to 250 psi. Large plants, too—where space and load characteristics warrant—may profitably consider several packaged boilers as against a "tailor-made" installation.

Coordinated, designed, and built under a single responsibility, this new unit is backed by the same tradition of service-satisfaction that has identified B&W with reliable, low-cost steam generation for more than 80 years.

Send for bulletin G-72, detailing the many advantages of this new B&W creation in low-cost steam generation. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.

BABCOCK & WILCOX



COST-SAVING FEATURES OF THE NEW B&W INTEGRAL-FURNACE BOILER, TYPE FM

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

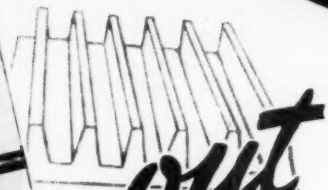
G-4707

HOW A PROCESS OF

makes

with the tubular vent condenser

with its many small tubes and constant maintenance problem. Instead, an inlet spray unit and simply designed vent collecting hood (both shown at right) do the work of the former complicated and somewhat troublesome unit. The new design normally requires no maintenance, although if inspection is desired the inlet spray unit can easily be disconnected and withdrawn. A further advantage is the saving of headroom, the spray unit and vent collecting hood being inside the shell.



with heavy cast iron trays

Stainless steel, spot welded, is the new tray material. Fabricated on up-to-the-minute principles for strength and rigidity, the new construction gives equal tray capacity in a given space, at only one-fourth the weight of cast-iron trays. As the photo shows, a light, stainless steel tray can be easily handled by a man with no lifting equipment required.

N-999

ELLIOTT

TRAY-TYPE
no moving parts

ELIMINATION
better deaerating heaters

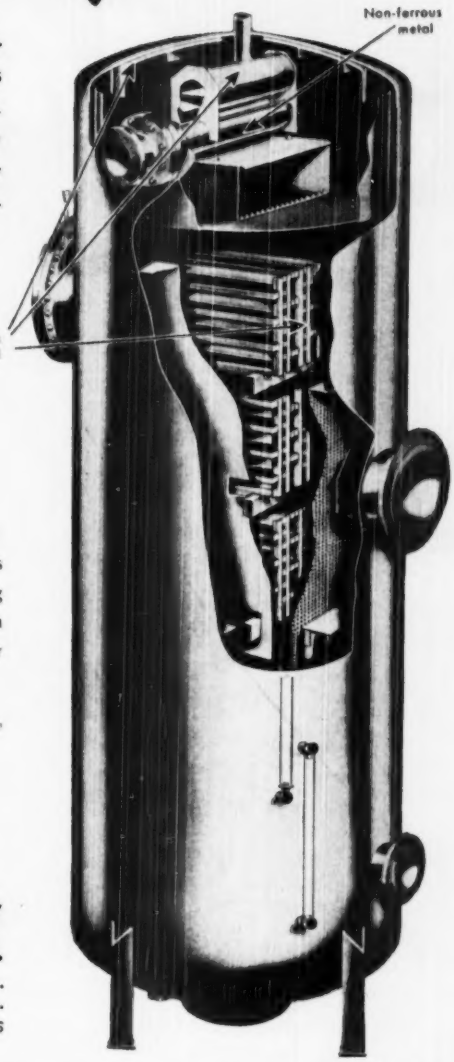
• Perhaps we should call it a process of substitution—the replacing of trouble-causing elements with better, more enduring design and materials. In any case, the Elliott deaerating feedwater heater of today is as far ahead of contemporary practice as was the first trail-blazing Elliott deaerator of three decades ago in its time.

with corrodible materials

Wherever corrosion may occur, stainless steel or non-ferrous metal is used. Stainless steel is used for the vent collecting hood and inner head to prevent non-deaerated water from coming in contact with the outer shell. The inlet spray assembly is of non-ferrous metal.

Here again is a further saving in major maintenance expense, and an assurance of many years of service.

The complete story on this trouble-eliminating unit is covered in Deaerator Bulletin N-16, on request.

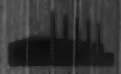


ELLIOTT COMPANY
Deaerator and Heater Dept., JEANNETTE, PA.
Plants at: JEANNETTE, PA. • RIDGWAY, PA. AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

DEAERATING FEEDWATER HEATERS
no tubular vent condenser • minimum maintenance

AGAIN...IN 1950

DIAMOND



NORTH

*Central Illinois Electric & Gas Co.
Rockford

*Central Illinois Public Service Co.
Hutsonville

Cincinnati Gas & Electric Co.
Clermont

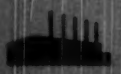
Illinois Power Co.
Hennepin

Indiana & Michigan Electric Co.
Tanners Creek

*Northern States Power Co.
Sioux Falls

*Ohio Edison Co.
Burger

*Public Service Company of Indiana
Edwardsport



SOUTH

*Alabama Power Co.
Gorgas

*Appalachian Electric Power Co.
Philip Sporn

*Carolina Power and Light Co.
Goldsboro

*Carolina Power and Light Co.
Lumberton

*Consolidated Gas, Electric Light & Power Co.
Gould Street

Georgia Power Co.
Brunswick

*Georgia Power Co.
Plant Yates

*Louisville Gas and Electric Co.
Paddy's Run

*The Ohio Power Co.
Philip Sporn

Tennessee Valley Authority
New Johnsonville

Tennessee Valley Authority
Bridgeport

*Virginia Electric and Power Co.
Possum Point

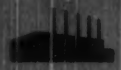
***REPEAT CONTRACTS FOR SAME STATION*

In 1950, as in '49, '48, '47, etc., leading public utilities are indicating nationwide preference for Diamond Soot Blowers. Conclusive evidence is in this list of central station contracts (complete steam generators only) above 600 psi for the first eight months of 1950. TODAY . . . as yesterday . . . Diamond Dominates in soot blowers.

DIAMOND POWER SPECIALTY CORPORATION
LANCASTER, OHIO
Diamond Specialty Limited—Windsor, Ontario

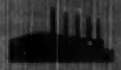
DOMINATES

IN SOOT BLOWERS



EAST

- Central Hudson Gas and Electric Co.
  Danskammer
- Central Maine Power Co.
  Mason
- Consolidated Edison Co.
  Astoria
- *Jersey Central Power and Light Co.
  South Amboy
- Maine Public Service Co.
  Caribou
- *Niagara Mohawk Power Corp.
  Oswego
- *Potomac Electric Power Co.
  Benning
- *Public Service Electric and Gas Co.
  Sewaren



WEST

- *Interstate Power Co.
  Dubuque
- *Iowa Power and Light Co.
  Des Moines
- *Kansas Power and Light Co.
  Tecumseh
- *Kansas Power and Light Co.
  Lawrence
- *Public Service Company of Colorado
  Arapahoe
- *San Diego Gas and Electric Co.
  Silver Gate
- Southern Colorado Power Co.
  Rocky Ford
- Union Electric Company of Missouri
  Meramec

BETTER BOILER CLEANING AT LOWER COST
Is the Reason Why
DIAMOND DOMINATES

low-cost process heat

dependable low-speed power

GET BOTH with G-E

If your plant uses process steam, you may be able to improve over-all heat balance by driving low-speed equipment with General Electric geared turbines. Mechanical drive turbines act as reducing valves to drop boiler steam pressures down to utilization temperatures for process requirements. With turbines skimming off only a small portion of the steam's heat, mechanical power for driving fans, blowers, pumps and other low-speed apparatus is almost free.

Standard Type DP and DR turbines, combined with General Electric precision-type gears, are ideal for many such applications.

PRECISION GEARING

General Electric balanced-thrust gears are specifically designed for use with turbine drives. Smoothness and quietness of operation are the result of maintaining tooth contours and spacing to a high degree of accuracy.

Positive lubrication assures long life. Oil is delivered to the bearings from a gear-type pump driven by the pinion shaft. The gear mesh is spray-lubricated.

To meet a variety of application requirements, these gears are available in ratios from 1.5 to 10.3.

PRECISION GOVERNING

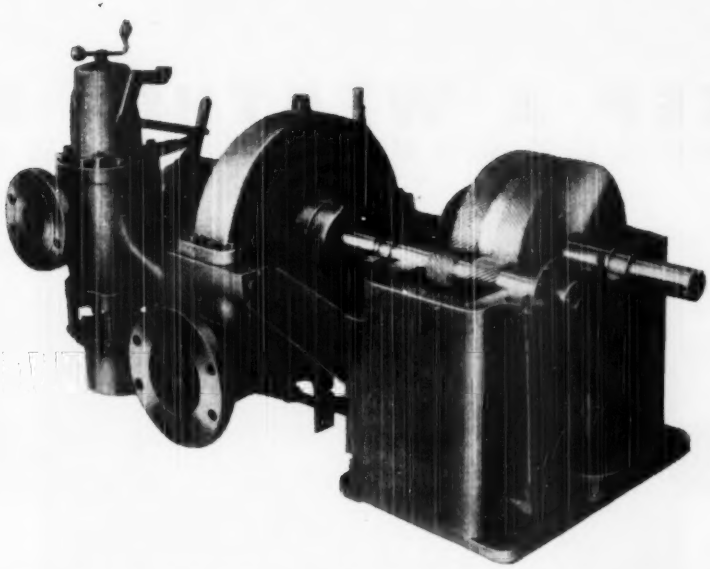
General Electric Type DP and DR turbines include extra features at no extra cost. The DP's hydraulic governing system provides a speed range of 30 per cent with 6 per cent regulation. The DR's oil-relayed governor offers speed ranges up to 5 to 1 with accuracy of ¼ of 1 per cent. Each turbine has its easily operated trip-throttle valve and governing valve combined in one compact unit. Rugged construction from quality materials makes these standard turbines outstanding for reliability and efficiency.

ONE INTEGRAL UNIT

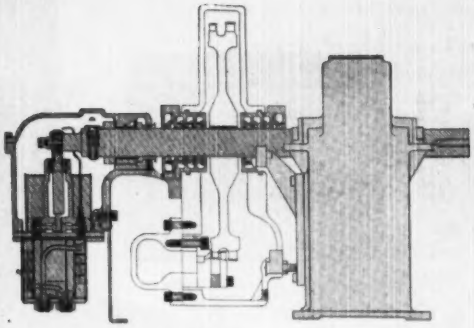
General Electric close-coupled turbine-gear sets have one common turbine and pinion shaft, with the turbine and gear casings solidly connected by a sturdy fabricated bracket. This construction results in a compact unit, does not require high-speed coupling.

Many standard parts are interchangeable with other turbine and turbine-gear drives.

Your nearby General Electric sales office will supply you with full details about mechanical-drive turbine-gear sets. Or, if you prefer, write for free copies of illustrated bulletins on these drives. The DP and DR turbines are described in bulletins GEA-4955 and GEA-5193. Bulletin GEA-5152 contains information about gears. Learn how installing these precision drives in your plant can save you money. Apparatus Department, General Electric Company, Schenectady 5, N. Y.



TURBINE-GEAR DRIVES

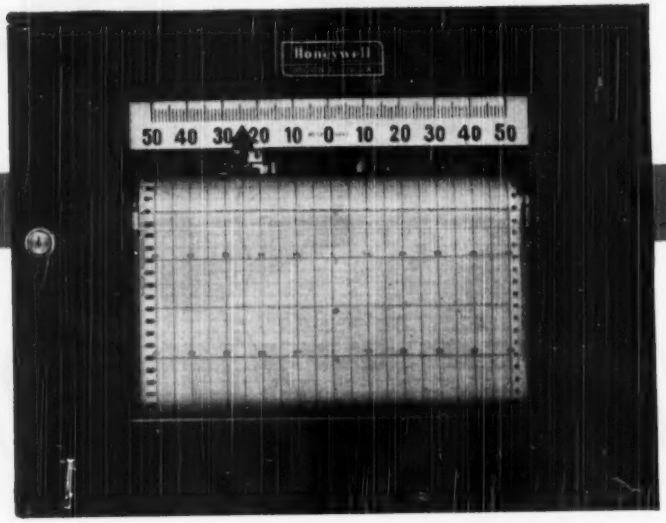


HERE'S WHAT STANDARDIZATION PROVIDES FOR YOU

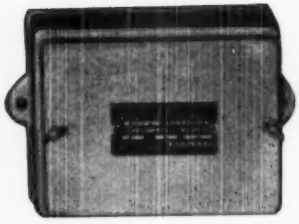
This diagram shows how a standard DP turbine is close-coupled to a low-speed gear using an integral turbine and pinion shaft. All shaded turbine parts are interchangeable on all sizes of DP turbines. Thus, it is easy to stock spares, and maintenance costs are reduced. All individual turbine models and gear sets have standard shaft heights for easy installation or re-location in your plant. In addition, standardization cuts manufacturing expense, and the savings are passed on to you in the form of extra features usually found only on "special" turbine-gear drives.

GENERAL ELECTRIC

KEEP A WEATHER EYE



Thermal converter



Auto-transformer

ON ALL THREE . . .

1 Individual Generator Output

2 Total Station Output

3 System Loads and Trends

. . . with this *ElectroniK* RECORDER and SPECIAL COMPONENTS

CONTINUOUS indication and recording of power generated is of prime importance to the operation of every central station.

The *ElectroniK* Strip-Chart Recorder, using a thermal converter, accurately provides such vital information when used as a wattmeter. And . . . with the help of a phase shifting auto-transformer and a thermal converter . . . it can be used as a varmeter, for accurate recording of the non-useful energy generated.

Total result: a preventive check on generator overloads; immediate information for load dispatching; easily filed tabulation of interchanged power.

This is another indication of how the Brown approach to instrumentation offers positive steps toward the maintenance of maximum operating efficiencies. For more detailed information, call in your local Honeywell engineer . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Phila. 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

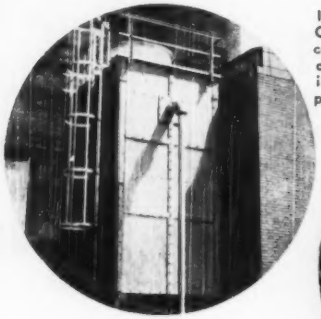
MINNEAPOLIS Honeywell

BROWN INSTRUMENTS

the same engineering excellence

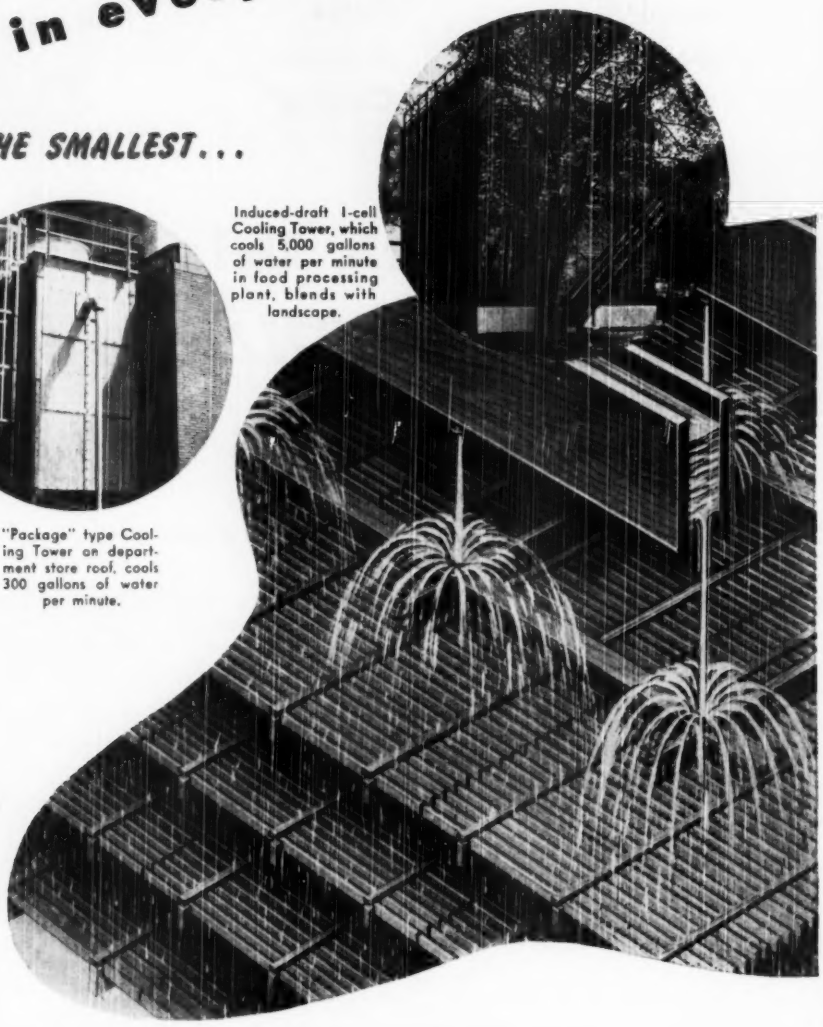
in every Foster Wheeler

FROM THE SMALLEST...



"Package" type Cooling Tower on department store roof, cools 300 gallons of water per minute.

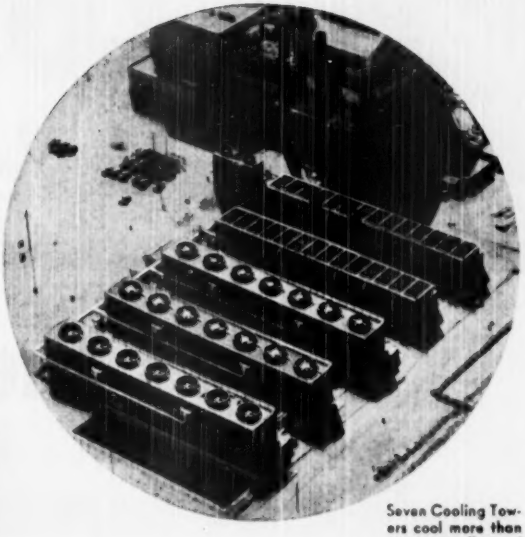
Induced-draft 1-cell Cooling Tower, which cools 5,000 gallons of water per minute in food processing plant, blends with landscape.



FOSTER WHEELER CORPORATION 165 BROADWAY

cooling tower

Induced-draft 6-cell Cooling Tower in oil refinery cools 10,300 gallons of water per minute.



Seven Cooling Towers cool more than 180,000 gallons of water per minute in large power plant.

. . . TO THE LARGEST

Whatever the application—a "package" type on a department store roof in New York City, a twenty-cell tower for a power plant in Arkansas, or a large unit for a chemical plant in India, Foster Wheeler Cooling Towers can be depended on to deliver full capacity in year-round service.

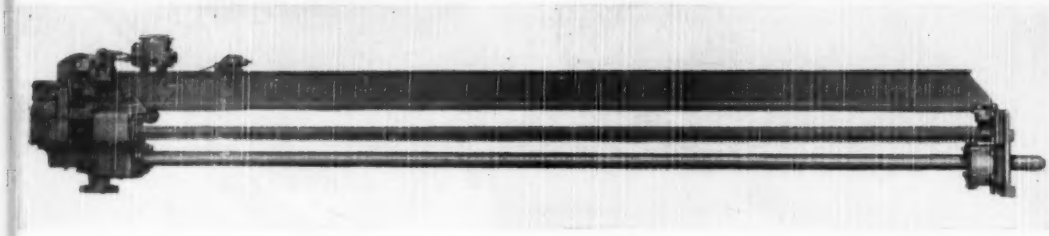
A Foster Wheeler Cooling Tower is your best guarantee of a constant supply of cooling water for steam power plants, processing, air conditioning, or other uses. Regardless of size, the same engineering and construction excellence, the same attention to detail and the same quality of materials go into every Foster Wheeler installation.

NEW YORK 6, NEW YORK

FOSTER FW WHEELER

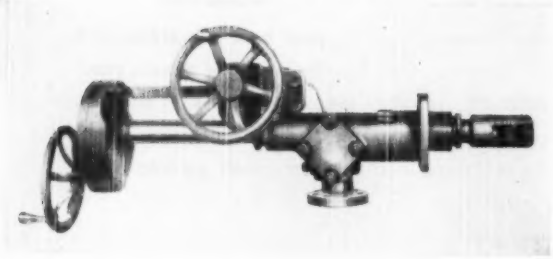
The "LONG" and *Better Boiler Cleaning*

Here's the LONG of it



Vulcan T-2 Long Retractable Blower, for travels up to 25 feet, is ideal for hard-to-clean surfaces. Lance shown retracted (not in action) for protection against high furnace temperatures, thus cutting maintenance costs. Operated by push button at unit or at central control panel. Install at any angle, indoors or outdoors.

Here's the SHORT of it



Manually-operated Vulcan HG-1 Gun Type Blower, 12- or 24-inch travel, blasts hard-to-clean deposits from boiler, water wall and superheater surfaces. Air or steam. Easy to operate. Practically no maintenance costs. For automatic operation, use Vulcan RW-1.

VULCAN *-Automatic*

the "SHORT" of
---at Lower Cost--

Is your soot blower maintenance too high? Is it costing you too much to keep your boilers clean? Then it's time to call in a Vulcan engineer to study your problem. Chances are he'll help you find ways to cut maintenance and cleaning costs materially. His survey will cost you nothing—and could save you a lot of money. No obligation. Just mail the coupon—NOW.

VULCAN SOOT BLOWER DIVISION
Continental Foundry & Machine Company
DUBOIS, PENNSYLVANIA

Mail this Coupon TODAY

VULCAN SOOT BLOWER DIVISION
DUBOIS, PENNSYLVANIA

Without obligation to me, please send your engineer to survey our soot blowing equipment and show us how we might cut our boiler cleaning costs.

NAME.....

POSITION.....

COMPANY.....

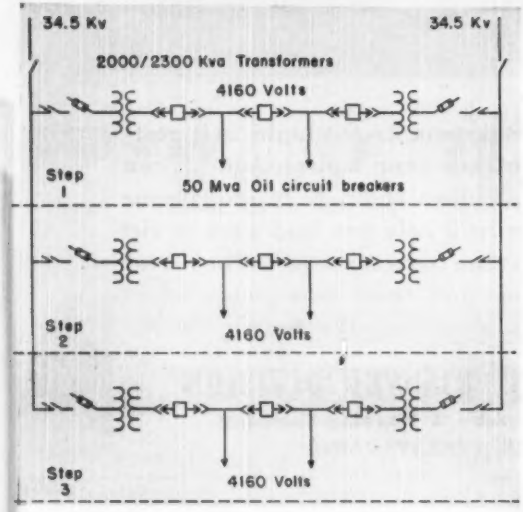
STREET ADDRESS.....

CITY..... STATE.....

Soot BLOWERS

UNIT SUBSTATION

LAYOUT WITH G-E SUBSTATIONS



STEP 1	GE Duplex Unit Substation and structure (including landscaping)	$57,000
	Installation	15,000
STEP 2	GE Duplex Unit Substation and structure plus installation	62,000
STEP 3	(Same as Step 2)	62,000
	Total cost	$196,000

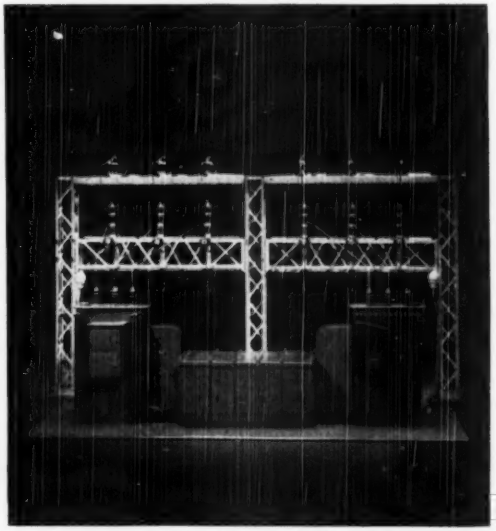
Note how the one-line diagram at the left, using General Electric Duplex Unit Substations, duplicates in every respect the electrical functions of the proposed piecemeal arrangement—at a savings of $84,000, or 30%. Individual feeder voltage regulation is economically obtained by load-ratio-control transformers, since each transformer normally serves only one feeder. The compact construction of the G-E substation made landscaping easy—and inexpensive.

General Electric Unit Substations give further savings by deferring investment costs and by allowing expansion to take place logically and when needed, and without the obsolescence of breakers. Also, the small units allow the use of breakers of relatively low interrupting rating.

When you order General Electric Unit Substations your engineering involves only a simple one-line diagram like the one above. We do all the detailed specs, prepare construction drawings, electrical diagrams, operating instructions and other paper work to give complete co-ordination of the project—all this on one purchase order, and at lower costs than piecemeal, field-assembled types.

For further information ask your G-E Sales Representative for the publications listed or write to *Apparatus Department, General Electric Company, Schenectady 5, N.Y.*

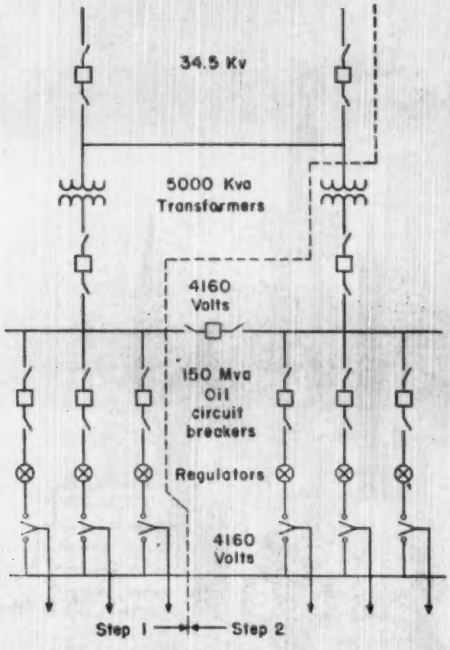
Master Unit Substations	GEA-3800
Single-circuit Unit Substations	GEA-4300
Package Substations	GEA-4500
Rural Package Substations	GEA-5276



Here's a view of a G-E Duplex Unit Substation similar to the ones in the layout above.

LAYOUT SAVES 30%

PROPOSED PIECEMEAL ARRANGEMENT



STEP 1	Three feeders and proportionate cost of brick building*	$180,000
STEP 2	Three feeders and remaining cost of brick building	100,000
	Total cost	$280,000

*Transformers and 34.5 kv breakers to be located outside behind ornamental brick building housing remainder of switchgear, regulators, etc.

This proposed piecemeal arrangement is of the spot network type. It is based on a typical installation using 1950 cost figures. Accurate feeder voltage control can be provided by separate voltage regulators on each feeder in conjunction with a regulator transfer bus.

To see how the G-E Duplex Unit Substation layout did the same job—at a savings of $84,000, or 30%—over the above arrangement, look at the layout on the opposite page.

GENERAL ELECTRIC

...a KVS designed..

Send for a copy of engineering bulletin No. 44-B containing valuable information on steam generation and coal pulverization.

..and built plant can be erected..

Anywhere and operated by ANYONE

NATIVE help is entirely competent to operate KVS plants. While these plants are complete from "bunker to bus bar" and modern in every detail, they are also designed for simplicity and ease of handling. Thus there need be no obstacle on the personnel side to attaining efficient operation from a KVS plant in any part of the world.

Automatic controls reduce operating personnel and operators can easily be trained.

KVS plants are designed for high efficiency. Any fuel can be used including low grade coal, also tailings, screenings, washings, etc. Low KW costs are assured.

Why not outline your conditions and let KVS Engineers cooperate with you. You will find them willing and competent to help you design, build and erect your plant anywhere.

What's YOUR Fuel-dollar

This Bailey Boiler Control Panel insures high efficiency in the use of Fuel-Dollars at a Western Chemical Plant. It includes Bailey Combustion Control, Bailey Three-Element Feed Water Control and Bailey Steam Pressure Reducing Control for two oil-fired boilers.

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

Efficiency ?

A dollar's worth of fuel has the *same potential* energy, no matter who's boiler it fires. But how much of the energy actually gets converted to a usable form depends on how you operate your boiler.

That's where Bailey Controls can help. And, here's why, we believe, you'll get better fuel-dollar efficiency with Bailey:

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

For better fuel-dollar efficiency—for more power per fuel-dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. Were proud to stand on our record: "More power to you!"

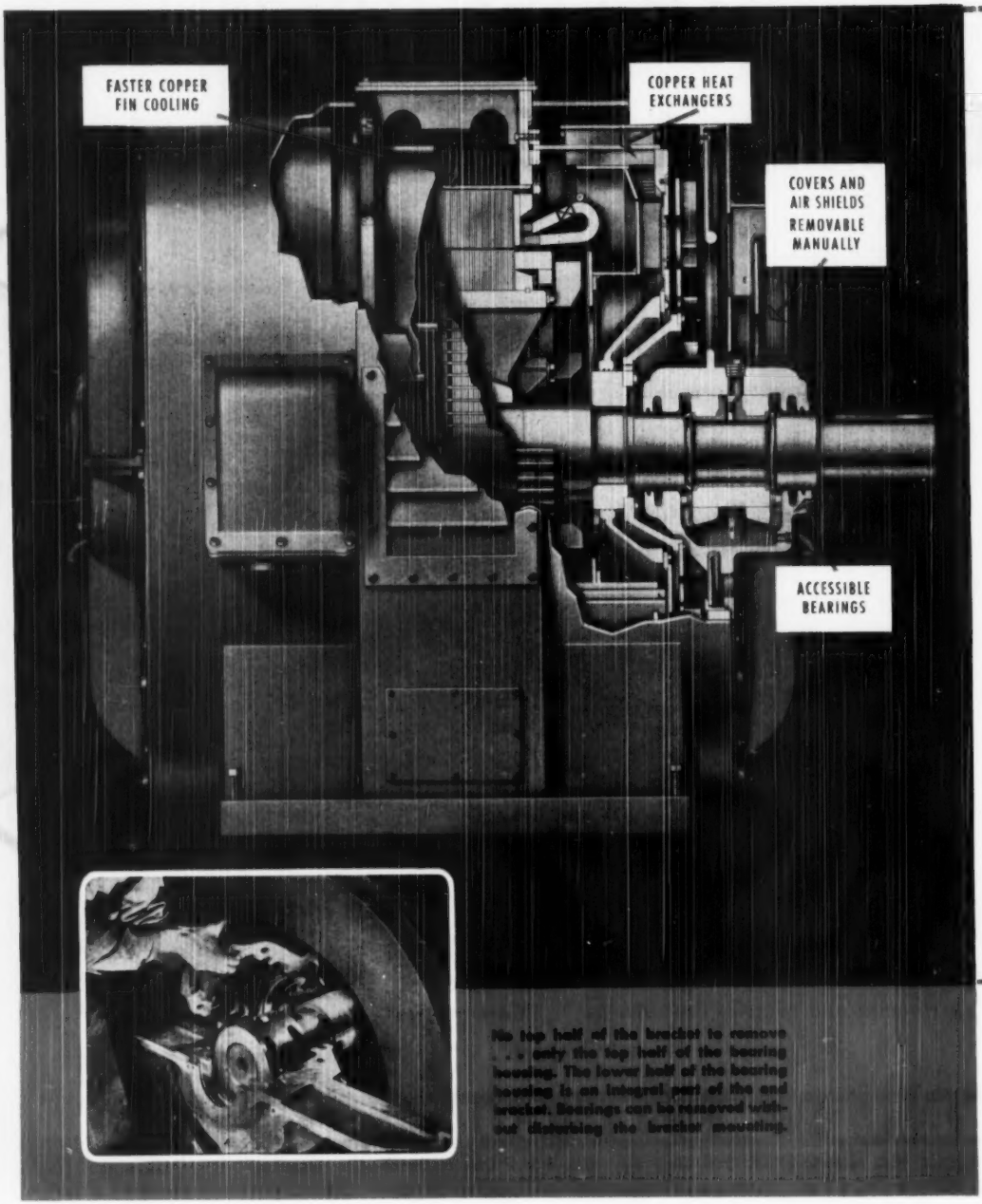
A-109

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

YOU CAN BE **SURE**.. IF IT'S
Westinghouse



No top half of the bracket to remove . . . only the top half of the bearing housing. The lower half of the bearing housing is an integral part of the end bracket. Bearings can be removed without disturbing the bracket mounting.

NEW LARGE INDUCTION MOTOR DESIGN

offers important advance in totally-enclosed, fan-cooled motors

Transfer of heat from totally-enclosed, fan-cooled, large motors is now accomplished more efficiently . . . more effectively.

New Westinghouse design and construction employ copper cooling fins to quickly dissipate heat from motor windings and stator core. Heat exchangers, also utilizing copper fins, provide efficient transfer of heat from internal circulating air into the path of the external cooling air. Further, this design permits totally-enclosed construction on frames which *require little more installation space than open motors* of the same rating.

Also included in the new Westinghouse Totally-enclosed, Fan-cooled Motor are basic design improvements common to other enclosure types of Westinghouse large motors. Many are features that contribute appreciably to lower installation and maintenance costs.

For example: sectional covers and air shields, easily removable, by hand; split bearing housings, with bearings readily accessible for inspection or replacement—without removing lower half of housing; sturdy frame of welded steel construction—stronger, smaller in size and lighter in weight.

Get the facts now—for immediate use or with an eye toward future requirements.

See your Westinghouse representative, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-21352

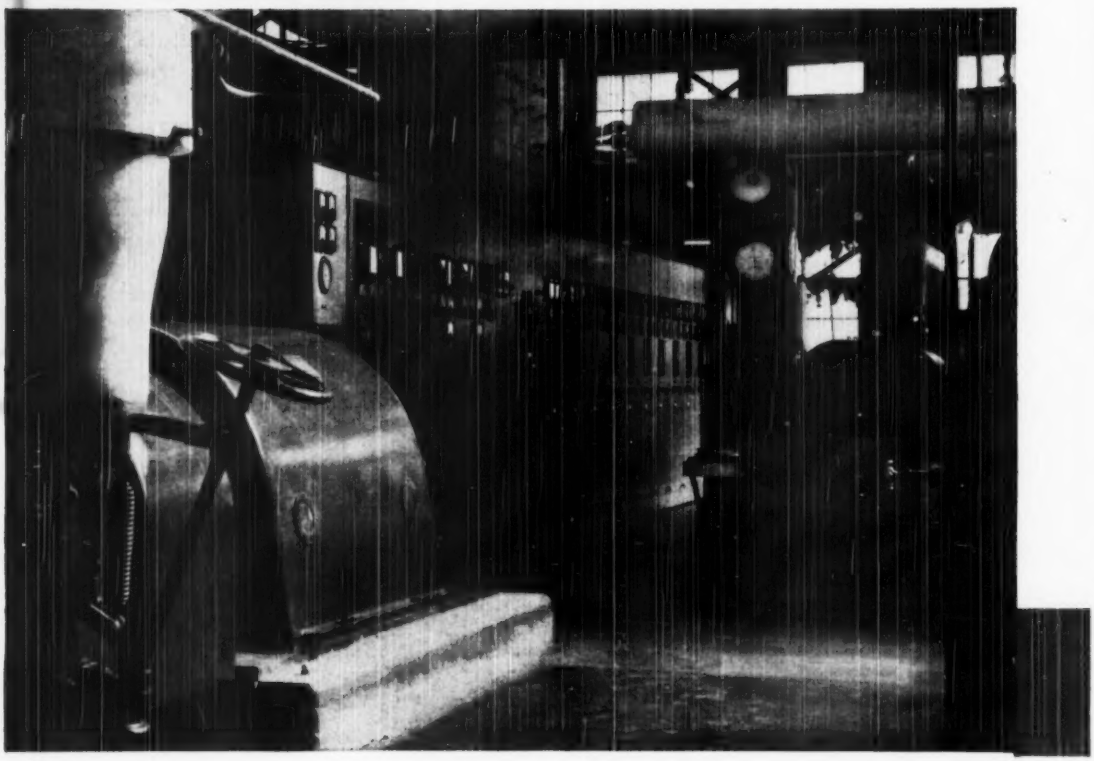
Westinghouse

LARGE INDUCTION MOTORS

FREEPORT SULPHUR EXPANDS

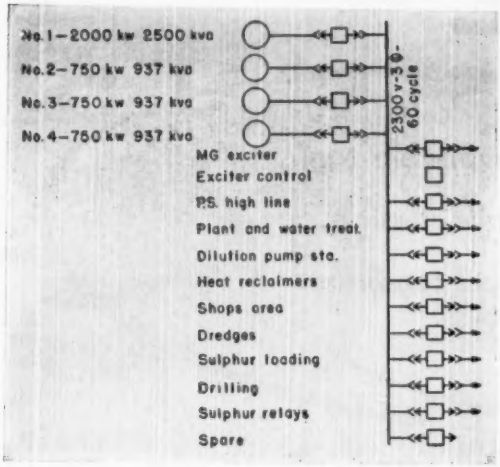
This inadequate, open-type switchgear was replaced by the new G-E Metal-clad equipment shown below. Freeport Sulphur officials recognized that the old switchgear had outgrown its usefulness.

Here's the new General Electric 5-kv Metal-clad switchgear installed at Freeport Sulphur. Magne-blast power circuit breakers have plenty of "IC" (Interrupting Capacity) to handle all short circuits that may occur on Freeport's expanded distribution system. This assures continuous power for vital production.



AND MODERNIZES WITH

METAL CLAD SWITCHGEAR



This one-line diagram shows power distribution at Freeport Sulphur as planned by Sargent and Lundy, consulting engineers of Chicago. General Electric Metal-clad switchgear handles the 2300-volt power from the generators through power circuit breakers of 100,000-kva interrupting rating.

The Freeport installation is a complete General Electric project—one source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.

Be sure to see the "More Power to America" full-color sound slide-film "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

WHEN Freeport Sulphur expanded their production facilities they put in a new turbine to take care of the increased load.

At the same time they replaced all their old equipment with General Electric switchgear.

When you order G-E switchgear you get all the equipment and service from one reliable source. And with everything pre-assembled at the factory it takes very little time to get the switchgear in place and operating.

MODERN INDUSTRIAL power distribution systems using G-E switchgear are applicable to any industrial plant or commercial building where you want. . . .

- Proper voltage for top performance of equipment
- An extremely flexible setup to take care of expanding or changing loads
- Adequate short-circuit protection
- Protection for personnel
- Low installation and maintenance costs

INVESTIGATE TODAY the many advantages of using General Electric switchgear to get the same benefits gained by Freeport Sulphur. Contact your G-E sales representative for further information—or write for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GEA-3083 Metal-clad Switchgear
GEA-4966 Low-voltage Metal-enclosed Switchgear
GEA-3592 Lead-center Unit Substations
GEA-3758 Lead-center Power Distribution

GENERAL ELECTRIC

C-E Assures you the right stoker

Right for your available coal

Right for your boiler design

Right for your load conditions

When you buy a stoker you want the type best suited to *your specific requirements*. You are sure of getting just that when you turn to Combustion Engineering-Superheater. Why? Because a background of more than 20,000 C-E Stoker installations (above residence size) makes available to you an accumulated experience unmatched by any other stoker manufacturer.

In addition, Combustion offers you the most complete line of stokers available today . . . a line that meets every requirement of fuel and load conditions. Therefore, as the manufacturer of *all* types of stokers, Combustion can give you impartial advice in helping you select the *right* stoker.

And at today's cost of coal, getting the *right* stoker can pay handsome dividends. For in an average installation the cost of coal used in a year exceeds many times the initial cost of the stoker. Thus the first cost of the stoker is soon absorbed by its saving in coal.

Typical of the complete C-E line are the three stokers on the opposite page — Skelly, Type E and Spreader. Each represents an outstanding value in its respective field. Each reflects the practical knowledge of fuels and operating conditions Combustion has gained through 60 years' experience in stoker design and application.

Day in and day out, all over the country, C-E Stokers are getting operating results as good or better than those anticipated at the time of purchase. In short, they are the *right* stokers for the job they were selected to do. So the next time you are in the market for stoker equipment, talk it over with Combustion before you buy. B-372

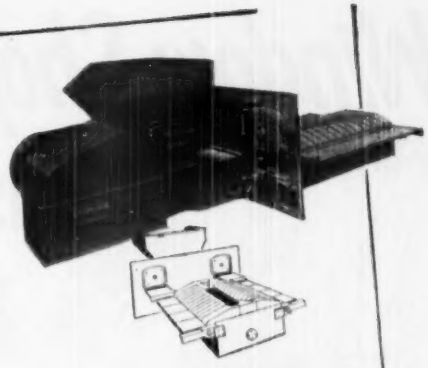
COMBUSTION ENGINEERING

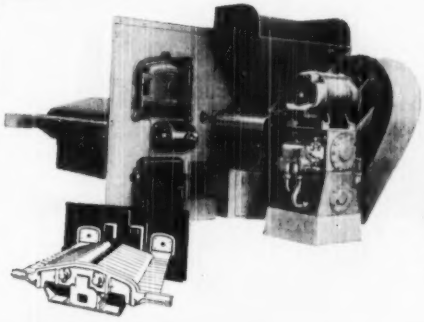
A MERGER OF COMBUSTION ENGINEERING COMPANY, INC. AND THE SUPERHEATER COMPANY

SKELLY STOKER UNIT

Approximate Application Range—20 to 200 boiler hp.

A compact, self-contained underfeed stoker available in designs for burning either anthracite or bituminous coal. An alternate arrangement of fixed and moving grate bars assures lateral distribution of fuel and maintains a clean porous fire. Cantilever dump grates of non-avalanching type simplify ash removal. An integral forced-draft fan, with inlet control, permits positive regulation of air-coal ratio. Sixteen rates of coal feed through variable-speed transmission. Automatic control is standard equipment. Timken bearing equipped. Alemite lubrication throughout.





TYPE E STOKER

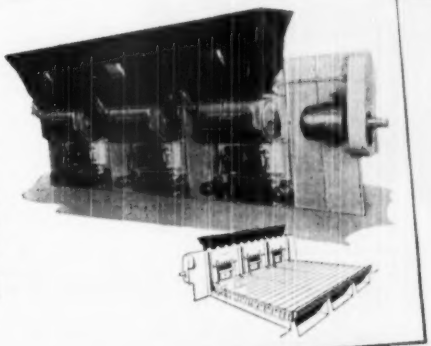
Approximate Application Range—150 to 600 boiler hp.

A single-retort, underfeed stoker designed to burn a wide variety of bituminous coals, particularly those having caking and coking characteristics. The Type E has ram type feed supplemented by a reciprocating sliding bottom. Its grate surface consists of hollow, air-cooled grate bars arranged in an alternately fixed and moving relationship to condition the fuel bed and assure its steady movement to the dump trays which are of the cantilever type. Air supply is under zoned control with provision for introduction of air over the fire. Type E Stokers are available with steam, electric or hydraulic drive.

SPREADER STOKER

Approximate Application Range—150 boiler hp. up to units producing 200,000 lb of steam per hr, or more.

The C-E Spreader Stoker is available in both dumping grate and continuous discharge types. This simple, rugged stoker is designed to burn a wide variety of coals. Hopper, feeding and distributing mechanism, variable-speed drive and motor are combined in a compact unit. Rotating spreader blades feed coal into the furnace in crisscrossing streams which assure uniform distribution. Fines are burned in suspension and the rest of the coal is burned on the grate. Grate surface is zoned for regulating air admission and to facilitate cleaning. All parts subject to wear are readily accessible for inspection, adjustment or replacement, when necessary. Rate of fuel feed and air supply may be regulated over a wide range and are readily adaptable to automatic control.

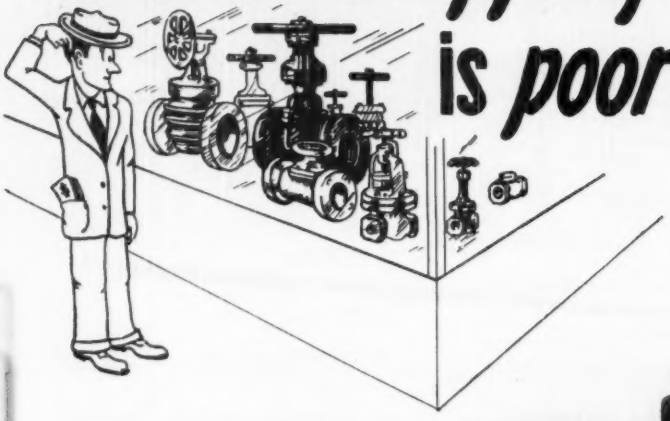


— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

"Window Shopping" for Valves is poor economy



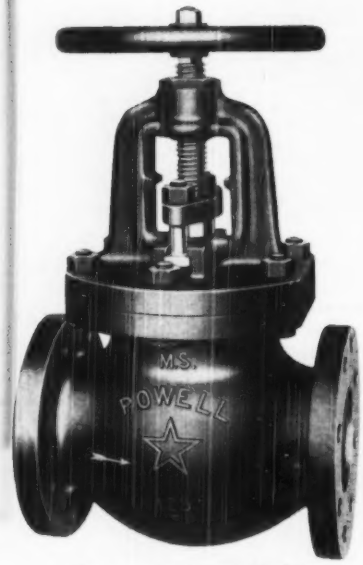


Fig. 241—Large 125-pound Iron Body Bronze Mounted Globe Valve. Sizes 2" to 16", incl. Has outside screw rising stem, bolted flanged yoke and regrindable, renewable bronze seat and disc.

Fig. 11323 W. E.—Class 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends. The top-mounted electric motor operator provides quick positive opening and closing by remote control.

POWELL

Reading advertisements is like "window shopping"—it's a good way to see what's on the market. But don't let it influence you into buying your flow control equipment from different sources.

Because if you buy all your valves from one source you avoid these pitfalls:

Complications in stocking spare valve parts.

Difficulties that confront the maintenance department in making repairs on a variety of valves.

The necessity of carrying a much larger stock of repair parts.

The chances of installing valves that are not backed by adequate engineering service.

By offering the *only* COMPLETE line of valves available to Industry today, Powell makes this possible. And if you consult Powell Engineers and select the right valve to suit each individual service, your flow control problems are ended.

Fig. 375—200 pound Bronze Gate Valve. Screwed ends, inside screw rising stem, union bonnet and renewable wear-resisting "Powellium" nickel-bronze disc.

Fig. 606 W. E.—Class 600-pound Cast Steel Swing Check Valve with welding ends and bolted cap. Disc has ample lift to permit full, straightway, unobstructed flow through the valve body.

Fig. 1367-A—Class 1500-pound Cast Steel Pressure Seal Angle Check Valve. "Y" check valves are also available.

Illustrated, descriptive circular on Powell Integral Bonnet and Pressure Seal Check Valves will be mailed on request.

Fig. 1314-A—Class 1500-pound Cast Steel Integral Bonnet "Y" Valve. Globe and Angle Valves also available.

The Complete Powell Line includes Globe, Angle, "Y", Gate, Check, Non-return, Relief, and Flush Bottom Tank Valves in Bronze, Iron, Steel and a wide range of Corrosion-resistant metals and alloys.

Ask your nearest Distributor—or write direct

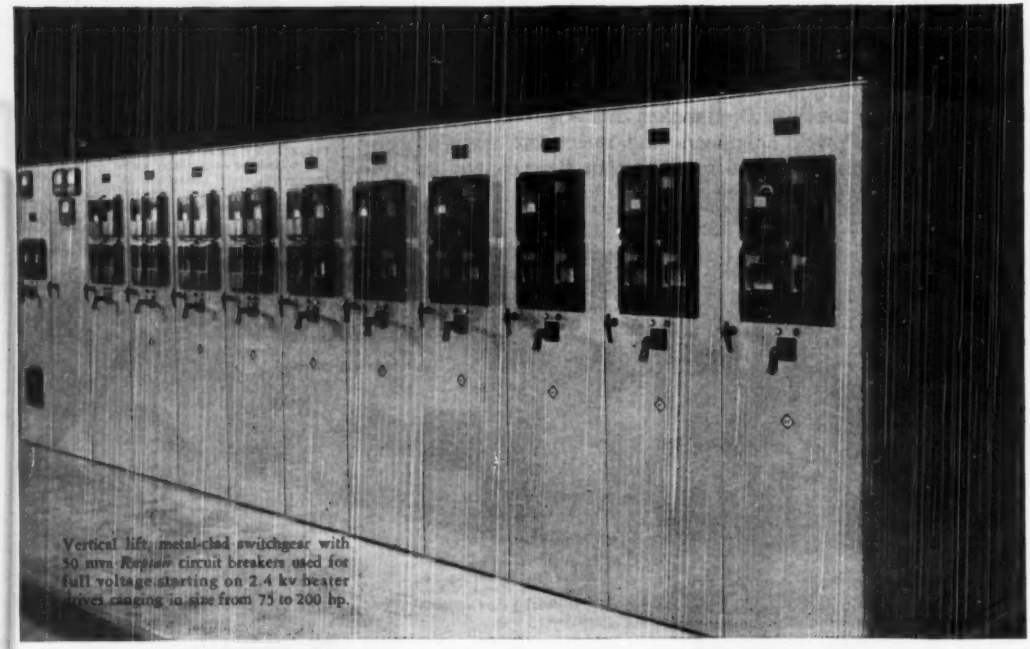
The WM. POWELL Co., 2525 Spring Grove Ave.

P. O. Box 106, Station B, Cincinnati 22, Ohio

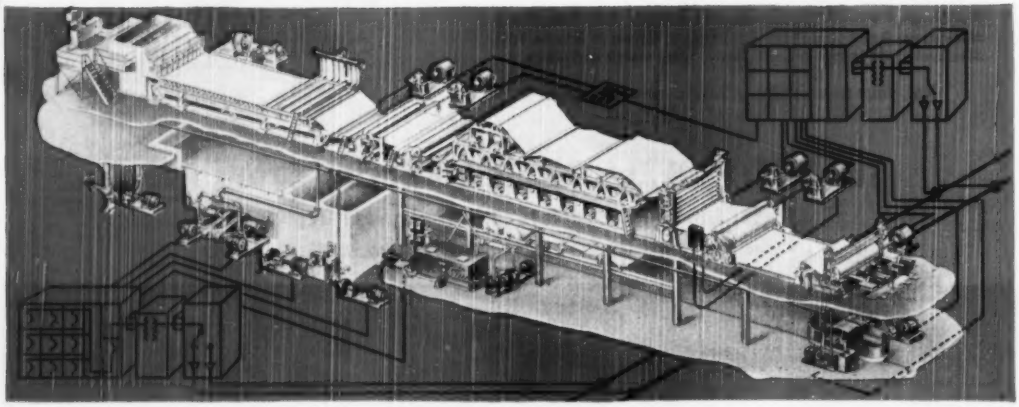
DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

VALVES

How Allis-Chalmers Production of Fine



Vertical lift, metal-clad switchgear with 50 mva *Reyrolle* circuit breakers used for full voltage starting on 2.4 kv heater drives ranging in size from 75 to 200 hp.



Hammermill's new paper machine is one of the world's largest and most modern. Wash drawing shows how Allis-Chalmers switchgear protects auxiliary equipment...aids in production of a better paper of correct weight, thickness and strength.

Switchgear Safeguards Hammermill Papers

World-Famed Producer of Fine Writing Paper Uses Allis-Chalmers High and Low Voltage Switchgear For Important Beater and Paper Machine Operations.

WHEN YOU CONSIDER that the paper industry ranks first in power-used-per-ton product, you can understand how vital electrical power is to its high speed mechanization.

Hammermill Paper Co. produces an important share of America's 21,000,000 tons of paper. High speed machines, running 24 hours a day, 6 days a week produce high quality finished paper of the right weight, printability, finish, thickness, and strength . . . all requiring *dependable* electric power, *reliable* protection against overloads!

In the beater room where pulp fibers are refined, Allis-Chalmers metal-clad, vertical lift switchgear provides full voltage starting for beater drives. This 2300 volt switchgear with AM-50 *Ruptair* circuit breakers is designed to operate under excessive moisture conditions and with its transformer completes a 1500 kva unit substation. 750 kva unit substation feeds power to 150 hp beater drives.

750 kva 13.8/0.48 kv, unit substation in the No. 7 paper machine beater room. Switchgear serves paper machine auxiliaries: vacuum pumps, stock and water pumps and rewinder drive.

Ruptair is an Allis-Chalmers trademark.

Hammermill's new paper making machine is one of the world's largest and most modern. Behind its many motors, pumps, and drives is Allis-Chalmers power protection. Here's an installation where inadequate protection would be costly and where split second circuit interruption is important in case of emergency. A-C Low Voltage metal enclosed switchgear protects the auxiliary equipment.

By furnishing modern and reliable circuit protection . . . Allis-Chalmers switchgear is helping Hammermill produce a better paper, saving pulp fibres and getting better performance from electrical equipment.

Beater room where stock is prepared for use has APWWT 150 hp, 585 rpm motors on rugged 24 hour duty.

* * *

The switchgear installation at Hammermill Paper Co. is another example of how *standard* Allis-Chalmers switchgear is providing the answers to many distribution problems.

A-C metal-clad switchgear is built to meet your needs. Fast acting circuit breakers clear faults as quickly as they develop. Silver-alloy, wear and heat resistant contacts are virtually indestructible.

MEETS SAFETY STANDARDS

This switchgear meets all NEMA and ASA standards of safety and performance. It arrives factory assembled, complete with accessories and is ready to operate when delivered.

A-C vertical lift high voltage switchgear is simple to remove for test, inspection or maintenance. Safety features include fully automatic shutters, positive interlocks and isolated component parts.

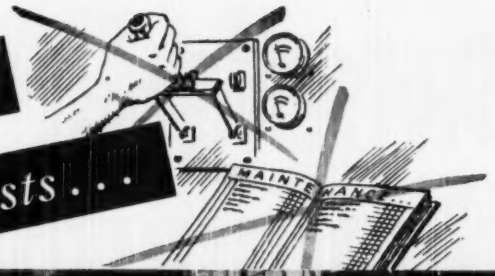
A-3114

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

First in the U. S. with Metal-Clad Switchgear

No Shutdowns . . .
No Repair Costs . . .



IN 30 MONTHS OF STEADY OPERATION!

Three Worthington YC-2 Compressors on general air service in the Reo Motors Company Plant, Lansing, Michigan. Two of these units ran for 2½ years, the other (a later installation) for 2 years, before all three had their first routine examination. During that time they operated approximately 16 hours per day, 5 days per week, without a single shutdown for maintenance.

Worthington YC-2 Compressors Provide Reo Motors Plant With Trouble-Free, Low-Cost Air Service

Freedom from maintenance worries is just one of the many advantages you get with Worthington YC-2 Compressors. Installation is quick, easy and inexpensive. A YC-2 comes completely assembled — there's no alignment problem and you don't need an erecting engineer. Requiring only half the space and one-quarter the foundation of same-capacity horizontals, it's ready for work as soon as connections are completed — at big savings in time, labor and money.

You get steady savings on operating costs, too, thanks to advanced features like the balanced Y-frame for higher rpm . . . the power-thrifty, instantly responsive 3 and 5-step variable capacity control . . . and Worthington Feather* Valves, most efficient and economical ever made.

GET ALL THE FACTS

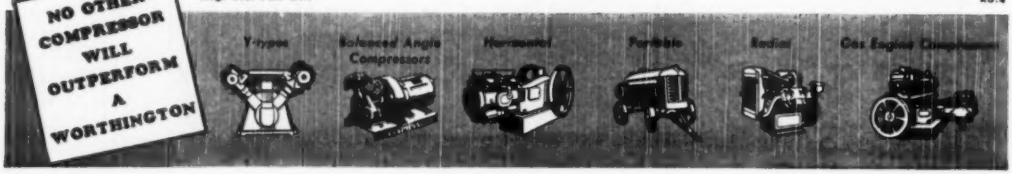
on how YC-2's can cut your air costs — from the first day on! Bulletin L-667-B1A gives you the whole economy story with further proof that *there's more worth in Worthington.* Write to *Worthington Pump and Machinery Corporation, Compressor Division, Buffalo, New York.*

WORTHINGTON

*Reg. U.S. Pat. Off.

KO.4

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON



Schooled to serve you...

YOU benefit when these men go to school!

These men are Standard Oil lubrication specialists, skilled and experienced in the use of modern lubricants. They are representative of the groups who come year after year from Standard Oil Company (Indiana) sales fields throughout the Midwest to learn about new machinery and the most up-to-date methods of lubricating them. In lecture rooms and in well-equipped laboratories, they are taught new ways to raise economy and efficiency of your operations.

The benefits held out to you by these lubrication specialists are multiplied by a service-distribution set-up that is unique in the oil industry. To serve your midwest operations, Standard Oil has located practically right in your own backyard a completely stocked warehouse and the office headquarters for a lubrication specialist. The nearness of this service-supply center *means faster deliveries to you* of necessary fuels and lubricants. It assures you of getting the product you need when you need it. It puts the services of the lubrication specialist at your immediate disposal.

These advantages are well worth investigating. Arrange, now, for the visit of a lubrication specialist. If your plant is located in any of the states below, simply phone your nearby Standard Oil service-supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

3 IMPORTANT ADVANTAGES

Standard Oil's Lubrication Service is especially geared to serve your midwest operations.

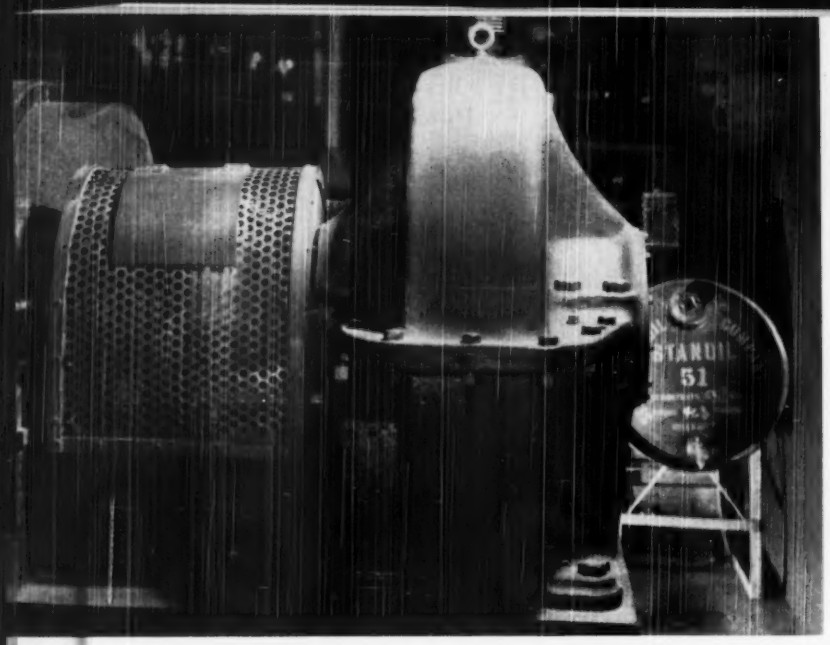
1 SERVICE-SUPPLY POINTS are near your plant. You are assured of fast deliveries, prompt lubrication engineering service.

2 LUBRICATION SPECIALISTS have been specifically trained in Standard Oil Lubrication Engineering Schools to help you obtain the maximum benefits from lubricants and fuels.

3 RESEARCH AND TECHNICAL FACILITIES are geared to help solve your specific lubrication problems.

Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Montana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, Wisconsin, Wyoming

STANDARD OIL COMPANY (INDIANA) STANDARD



Arrest the dirty work in reduction gears

THE dirty work starts in reduction gears when the lubricating oil begins to oxidize and break down under the attack of heat and air. Oxidation products, uniting with dust and other foreign matter, form deposits which interfere with proper lubrication and cause gear wear.

STANOIL
TRADE MARK
Industrial Oil

You can head off this dirty work—avoid costly cleaning jobs, oil changes, and gear wear—by using STANOIL Industrial Oil. The high stability of STANOIL prevents deterioration by heat. Its low-carbon-forming base oil keeps gears free from carbon. An inhibitor curbs acidity growth which would cause the formation of emulsions and sludge.

The many qualities of this one oil enable it to handle a wide variety of jobs in your plant. To assure you maximum benefits from STANOIL and other high-quality petroleum products, the Standard Oil Company has a well-trained and experienced lubrication specialist located practically at your doorstep. How you can profit by this unique product-service combination is explained at the right.

Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Illinois.

What's YOUR problem?

● To help you solve particular lubrication problems or gain greater all-around economy, Standard Oil has set up an industrial service that's unrivalled in the Midwest. This service puts at your immediate disposal the help of a highly trained, experienced lubrication specialist and a reliable supply of petroleum products. All you need do is phone or address a card to the nearest Standard Oil Company (Indiana) office. In fact, why not start right now by arranging for the visit of the lubrication specialist assigned to your plant. With his help, find how many different oils in your plant can be replaced by STANOIL Industrial Oil on such applications as:

Hydraulic systems...cleaner operation, no foaming troubles

Air compressors . . . no sticking or clogging of valves, less oil consumption in splash or circulating systems.

Speed reducers . . . less wear of gears and bearings during frequent cold starts or prolonged high-temperature operation.

Steam turbines...freedom from emulsions and sludge, fewer oil changes necessary.

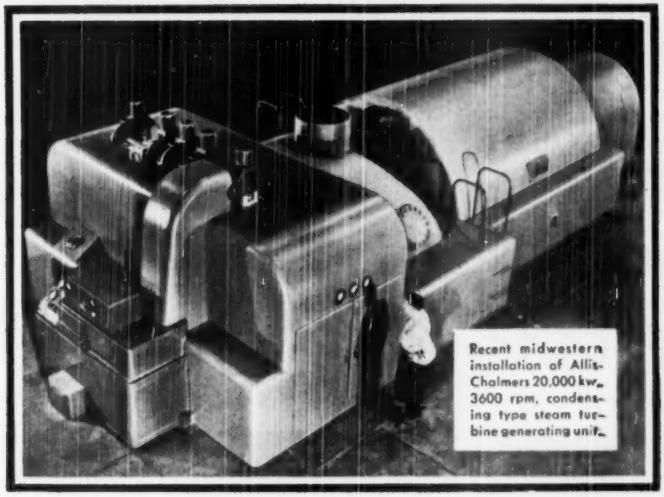
Ring-oiled bearings . . . rings function immediately on starting, less bearing wear.

Circulating and bath systems ...one oil for a wide variety of jobs.

STANDARD **STANDARD OIL COMPANY (INDIANA)**

America's Expanding Industry Powered by

STEAM TURBINE GENERATORS!



Recent midwestern installation of Allis-Chalmers 20,000 kw., 3600 rpm, condensing type steam turbine generating unit.

OVER 70 PERCENT of U. S. electric power now comes from steam turbine driven generators! This is proof that industry increasingly recognizes the dependability and economy of steam turbines in supporting America's industrial expansion.

With a background of *80 years* building steam prime movers, Allis-Chalmers continues to refine and improve steam turbine generator units. Progress is to higher pressures and temperatures, providing more economy, with even greater reliability.

If it's an A-C steam turbine, it has the latest *proved* features and is durably built to provide continuous service far into the future. Thousands of veteran Allis-Chalmers steam turbines in power plants today are producing power quietly and continuously for America's widespread industry.

When you install or expand your steam power plant, consider Allis-Chalmers. A-C provides a *complete* line of quality electric power equipment engineered to work together—generators, transformers, switchgear, circuit breakers, motors and control, pumps, steam condensers, and water conditioning. Literature available on all these products. Offices in all major cities. A-3169

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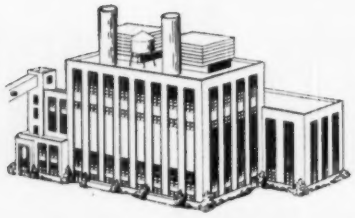
ALLIS-CHALMERS A-C

TURBINES & GENERATORS | CONDENSERS & PUMPS | SWITCHGEAR & BREAKERS | MOTORS & CONTROL | TRANSFORMERS | WATER CONDITIONING

World's Widest Range of Power Plant Equipment

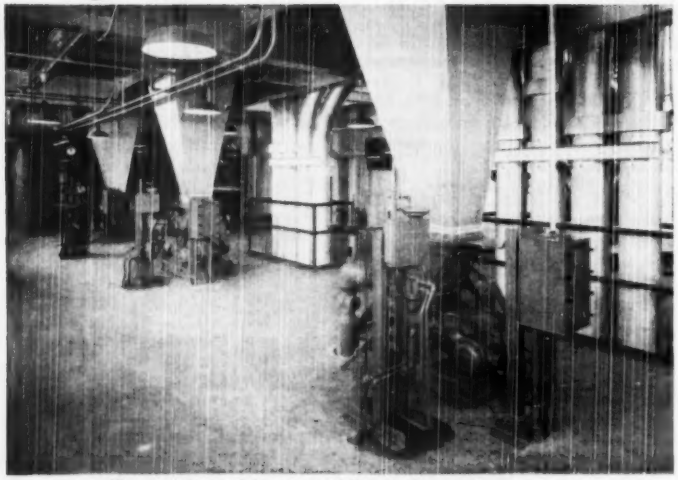


● at the New GADSDEN

Steam Plant of the

Alabama Power Company

Efficiency HAS BEEN



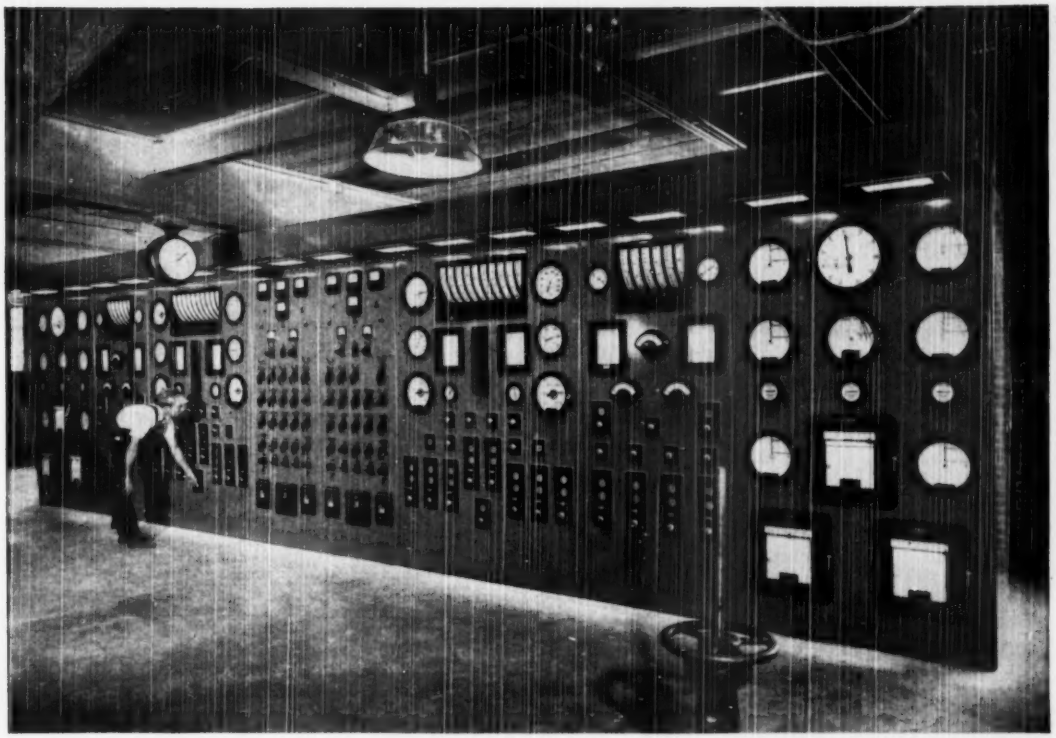
Three of the coal feeders and Republic regulators serving one of the boiler units.

It is the policy of Alabama Power Company to generate, transmit and distribute electricity to its customers at the lowest cost consistent with good service.

When designing the new 120,000 kw. Gadsden Steam Plant, the Alabama Power Company, in keeping with this policy, incorporated proven engineering developments which contribute to economical power generation. High among these was REPUBLIC automatic boiler control.

Two steam generators, each with a capacity of 600,000 pounds of steam per hour, and operated at 875 psig. and 885°F, supply steam to the two turbines. Fuels used are natural gas or pulverized coal, either singly, or in combinations.

The REPUBLIC control board is



On this Republic control board are mounted all gauges, meters and controls for operating each of the two boilers and their auxiliaries.

MADE *Automatic*

made up of one electrical panel, one recorder panel, and two combustion control panels per boiler. All panels are joined together to form one continuous board for the two boilers. The boilers are rubber mounted to reduce vibration, are gray in color, and lighted from an overhead canopy.

The REPUBLIC combustion control system receives its initial impulse from the main steam line through the master controller which establishes a pneumatic loading pressure proportional to the boiler load. The loading pressure is transmitted to the variable speed coal feeders, and to the gas flow valve when burning gas in combination with coal. This pressure is also transmitted to the air flow regulator. A corrector regulator provides means for maintaining the proper steam flow air flow relationship. Provision has also been made for manually adjusting this ratio from the boiler panel.

Air flow and furnace pressure are regulated by hydraulic coupling speed, but fan damper controls are provided for use at extremely low loads, when the fan speed would be reduced below 30% of the motor drive speed.

The boiler feedwater pumps are equipped with REPUBLIC automatic minimum flow hand reset valves. These valves open when the flow through the pumps is 150 gpm or less and by-pass this amount of water to the deaerating heater.

The REPUBLIC feedwater regulator is located on the operating floor and can be manually operated during emergencies from the boiler control panel. The valve control is pneumatic, single element, but the valve is operated by a hydraulic cylinder.

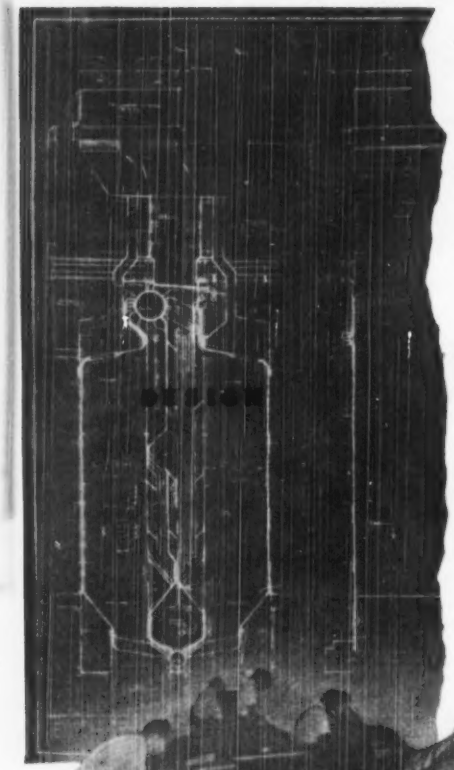
For complete information on REPUBLIC automatic boiler control write for Data Book No. S-21.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

Milestones of engineering

The modern Foster Wheeler Steam Generator, heart of many of the most efficient central station and industrial power plants in America and elsewhere, reflects the engineering and production ingenuity of an organization long recognized as a pioneer and innovator in the field of steam generation.

The story of Foster Wheeler achievement is best revealed by the following milestones of engineering progress:



1898—Aero pulverizers firing various fuels applied successfully on a commercial scale.

1902—Superheated steam introduced commercially in the United States.

1904—Convection superheaters standardized with cast iron, extended surface rings applied to steel tubes. Bare tubes later used with improved design technique and improved metal selection.

1912—Air preheaters of tubular type built and operated. Plate type heaters followed a few years later.

1917—Water tube boilers designed for production on a large scale—both oil and coal fired.

1919—Economizers of high pressure, extended surface, unit type introduced.

1919—Radiant superheaters developed after long research and experimentation.

EXPERIENCE...the priceless

progress

1924—Water walls and water backs applied to many types of furnaces burning various fuels.

1934—Pulverized anthracite burned in direct-fired system eliminating need for pulverized fuel storage.

1935—Radiant reheaters and radiant superheaters installed in one of the first large high pressure reheat units in the country.

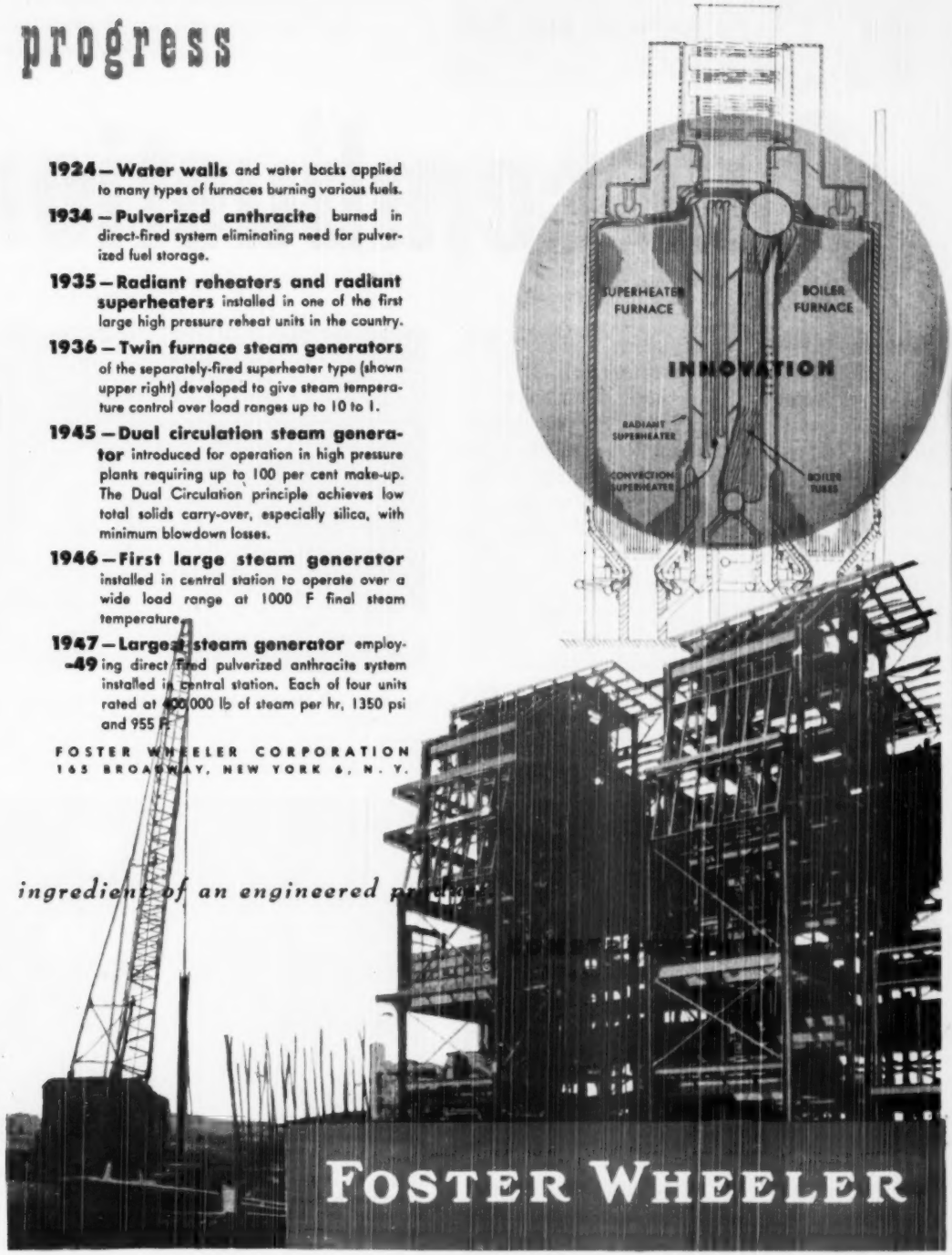
1936—Twin furnace steam generators of the separately-fired superheater type (shown upper right) developed to give steam temperature control over load ranges up to 10 to 1.

1945—Dual circulation steam generator introduced for operation in high pressure plants requiring up to 100 per cent make-up. The Dual Circulation principle achieves low total solids carry-over, especially silica, with minimum blowdown losses.

1946—First large steam generator installed in central station to operate over a wide load range at 1000 F final steam temperature.

1947—Largest steam generator employing direct-fired pulverized anthracite system installed in central station. Each of four units rated at 400,000 lb of steam per hr, 1350 psi and 955 F.

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.



ingredient of an engineered product

FOSTER WHEELER

what *results* do you want from

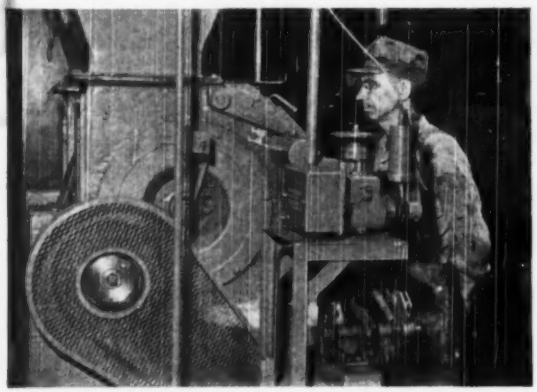
your combustion

"Will this help solve a problem?" "Will it help get better results?" Hays research, project engineering, manufacturing methods, plant analyses, and service are constantly being evaluated in terms of these two queries. Responsible plant management and engineering personnel want "results" . . . high efficiency, rapid response to load swings, fuel savings, good CO_2 and low maintenance costs.

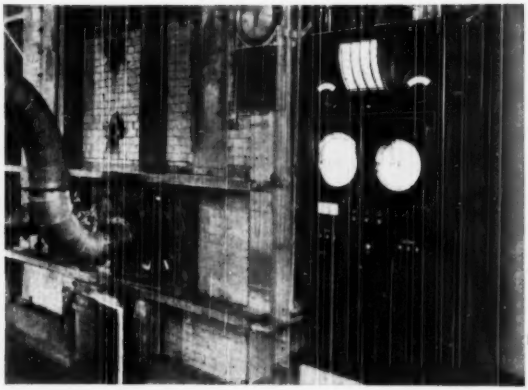
So we talk and think results. We apply this rule of thumb to our developing, producing, selling, and servicing, and help ourselves and the industries we serve.

Every power plant . . . every engineer faces specific problems and wants specific results. So Hays concentrates on actual plant problems and achieves definite results.

Increased efficiency? "Our basic reason for installing the Hays electric automatic combustion control was to obtain better efficiency. Our aim was more than reached . . . efficiency has climbed, attaining 79.3%." *Plant Engineer Manhattan Rubber Div., Raybestos-Manhattan, Inc.*



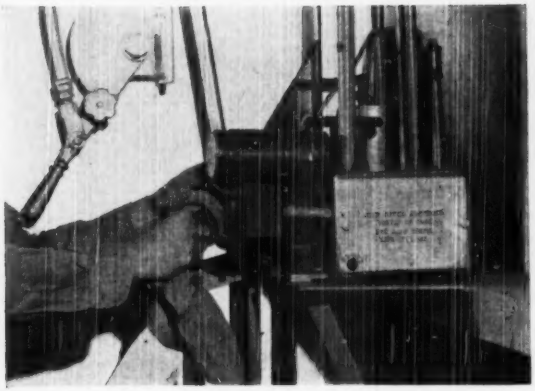
Rapid response to wide load swings? "We have made test runs using the Hays system, bringing the load rapidly up from 8,000 to 80,000 lbs. per hr. with excellent results. Fuel-air ratio was held at the desired value and CO_2 at 15%." *Chief Engineer of Power Plant, Bemis Bros. Bag Company*



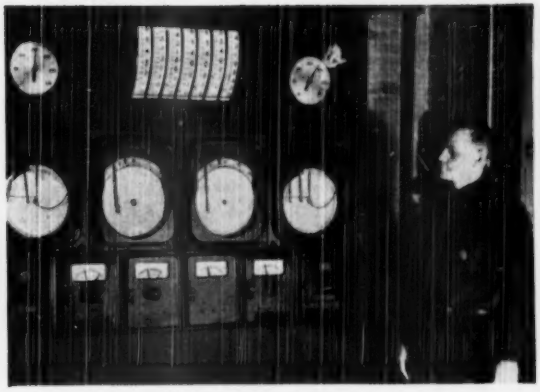
Good CO_2? "The (Hays) controls in combination with our instruments make it possible to maintain high efficiency, as indicated by the 14½% average CO_2 obtained, and keep complete records of our operation." *Chief Engineer, Geo. Ziegler Company*

Specific problems call for specific results. Here's proof that industrial plant management gets results as planned, with Hays Automatic combustion control systems.

control system?



Low maintenance? "Our aim has always been to eliminate the need for maintenance wherever possible . . . and we are particularly pleased that maintenance has been "nil" with the (Hays) automatic combustion control system."
Chief Engineer, Kurth Malting Company



Fuel savings? "Our fuel cost per pound of steam has dropped so much since we installed (Hays) instruments and combustion control, that fuel savings alone have been enough to pay for the investment in one year's operation."
Power Plant Chief Engineer, Vollrath Company

How to get results

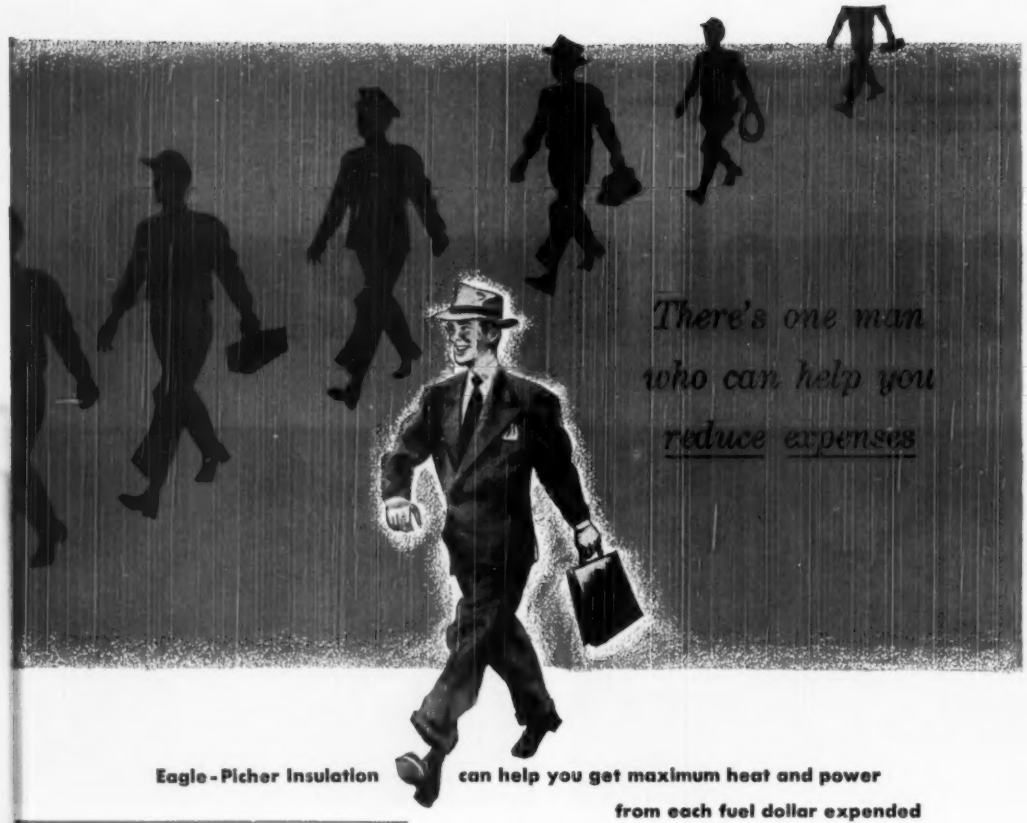
Hays application engineers will provide consultation on the special problems facing your plant. Through careful analysis, working with your actual operating conditions, they will recommend methods to achieve the results you want. Do you face any of these conditions?

Fuel savings—or special fuel problems
Plans to meet increasing load demand
Widely fluctuating loads
Improving efficiency in your plant
Problems in boiler and stoker maintenance
Meeting smoke abatement ordinances
Modernization of obsolete equipment
Accuracy of control in processing
Need for permanent records on combustion performance
Other . . .

Send for Bulletin No. 49-605 which describes how Hays equipment serves industry. For specific preliminary recommendations, without obligation, send us a brief statement of your combustion problem. Hays Corporation. Michigan City 3, Ind.

The Hays CORPORATION
MICHIGAN CITY INDIANA U.S.A.

AUTOMATIC COMBUSTION CONTROL • BOILER PANELS • FLOWMETERS • VERIFLOW METERS AND VERITROL • GAS ANALYZERS • DRAFT GAGES • COMBUSTION TEST SETS • CO_2 RECORDERS • ELECTRONIC OXYGEN RECORDERS • AIRFILTER GAGES



Eagle-Picher Insulation can help you get maximum heat and power from each fuel dollar expended

Here's insulation that will save you money

EAGLE-PICHER DE-85 BLOCKS

A highly efficient, rigid-type insulating material composed almost entirely of pure, lightweight, Eagle-Picher Diatomaceous Earth. High physical strength enables these blocks to stand up under usage normally encountered in installation. Adaptable to virtually all types of heated equipment. Can be cut with a knife, or sawed, to fit irregular shapes. DE-85 Blocks for temperatures to 1300°F. DE-95 Blocks for temperatures to 2000°F.

EAGLE-PICHER "99" FINISHING CEMENT

Finishing cement for temperatures up to 1000°F. Adheres tightly to hot or cold surfaces with practically no shrinkage. Highly durable. Gives a smooth, hard, light-colored, paintable surface.

EAGLE-PICHER STALASTIC
(Boiler Wall Coating)

Effectively seals against air infiltration through boiler settings—seals cracks and pores, effects substantial fuel savings. Great adhesive strength, retains its elasticity. For temperatures up to 400°F.

An Eagle-Picher Industrial Insulation distributor or representative can help you reduce operating expenses because he has available a wide line of insulation products—for high and low temperatures—scientifically designed for maximum thermal efficiency, and practical application. Why not let him give you more information about some of the products listed here?

These Eagle-Picher products can save you money . . . power . . . time

Insulating Felts • Superlemp Blocks • Blankets
Loose Wool • Pipe Covering • Stalastic • Insulseal • Insulstic
Swetchek • Finishing Cements • Insulating Cements
Fireproofing Cement • Diatomaceous Earth Blocks

THE EAGLE-PICHER COMPANY

General Offices: Cincinnati (1), Ohio

Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.

EAGLE EP PICHER

Since 1843

B500 • B101

19TH NATIONAL EXPOSITION
OF POWER AND MECHANICAL ENGINEERING
November 27-December 2, 1950
Booth 324-326, Grand Central Palace, New York

Get maximum fuel savings and exact temperature control with these versatile, efficient insulations

For a completely effective, low-cost insulation combination, you can't beat the teamwork of Eagle-Picher Supertemp Blocks, Diatomaceous Earth Blocks #85 (for temperatures to 1300°F.) and DE Blocks #95 (for temperatures to 2000°F.), Eagle-Picher Super "66" Insulating Cement, and Eagle-Picher Insulseal. They work effectively to give your equipment the highest possible thermal efficiency . . . cut operating costs by saving maximum amount of fuel . . . and help to provide perfect, precise control over temperatures.

EAGLE-PICHER SUPER "66" INSULATING CEMENT

Super "66" is all-purpose, rust-inhibitive, extremely adhesive insulating cement. "Springy ball" pellets don't collapse after application . . . give great coverage, retain their thermal efficiency. 100 lbs. covers 65 sq. ft.—1 inch thick! Easily applied with trowel, over flat and irregular surfaces. Efficient for temperatures up to 1800° F. Reclaimable when used on equipment whose temperatures go up to 1200° F.

EAGLE-PICHER SUPERTEMP BLOCKS

Eagle-Picher Supertemp Blocks are lightweight (approximately 16 lbs. per cu. ft.). Can be cut easily with knife or saw to fit off-shaped areas . . . they fit snugly over minor irregularities. They're strong and have high refractory value. Withstand temperatures up to 1700° F. Conductivity at 512° F. approximately 0.43 . . . all standard sizes, from 3" x 18" to 12" x 36" . . . in thicknesses from 1" to 4".

EAGLE-PICHER INSULSEAL

A tough, weatherproof, protective coating for insulation. For temperatures up to 450° F. Applied as a plastic, its smooth troweling qualities assure uniform coverage, proper thickness. It protects insulation from air infiltration, fumes, rain, snow, vibration, punctures, and withstands severe service, indoors or out. Dries to a smooth, rich black, has a neat appearance on hot or cold surfaces . . . may be washed or painted.

THE EAGLE-PICHER COMPANY General Offices: Cincinnati (1), Ohio

Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.

EAGLE EP PICHER *Since 1843*

Built to Cut Maintenance

EASIER MAINTENANCE PROCEDURES and lower maintenance costs are important features of this brand new line of large motors. One man can perform all routine maintenance procedures, including opening up the motor for cleaning. Bearing surfaces are not exposed to abrasive grit and dirt during cleaning operations.

The appearance of this new line of large motors reflects the advanced design and fine workmanship that goes into their manufacture.

A well-braced, sturdy fabricated steel frame with cast-iron end brackets rigidly support and protect working parts. Ventilating openings are large to provide adequate cooling air at low velocities with resultant low sound level.

Wide Range of Sizes

These new design Allis-Chalmers drip-proof and splash-proof squirrel-cage induction motors are built in sizes from 60 hp at 300 rpm to 1500 hp at 1800 rpm. Ask your Allis-Chalmers representative to show you the details of this exceptional new motor or write for Bulletin 05B6112.

How's This for Accessibility

One man can remove the end brackets and air baffles and reach right inside motor with his vacuum cleaner or air hose. Bearing remains sealed against abrasive dirt throughout the cleaning operation.

Large air discharge openings with removable louvers allow plenty of room to get in with an electric drill for doweling and bolting the motor to the base. Plenty of room to reach up back of the stator core for cleaning.

A-3179

ALLIS-CHALMERS, 952A SO. 70 ST.
MILWAUKEE, WIS.

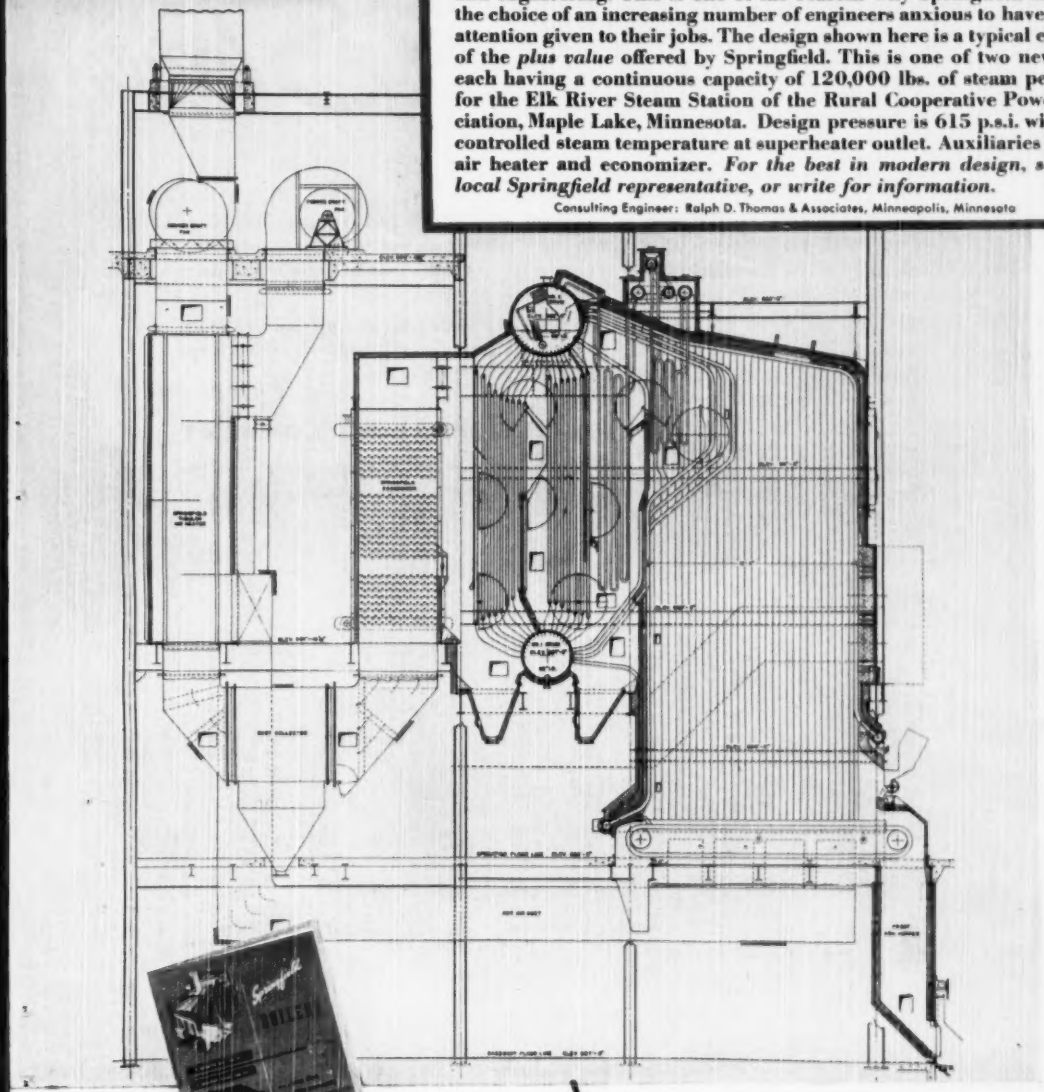
ALLIS-CHALMERS

Engineered

EFFICIENT! ACCESSIBLE! COMPACT!

WHEN your steam generating unit is built by Springfield, you can be sure of getting every benefit offered by Springfield experience and engineering. This is one of the reasons why Springfield has been the choice of an increasing number of engineers anxious to have careful attention given to their jobs. The design shown here is a typical example of the *plus value* offered by Springfield. This is one of two new units, each having a continuous capacity of 120,000 lbs. of steam per hour, for the Elk River Steam Station of the Rural Cooperative Power Association, Maple Lake, Minnesota. Design pressure is 615 p.s.i. with 830° controlled steam temperature at superheater outlet. Auxiliaries include air heater and economizer. *For the best in modern design, see your local Springfield representative, or write for information.*

Consulting Engineer: Ralph D. Thomas & Associates, Minneapolis, Minnesota



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CHECK WITH YOUR CONSULTING ENGINEER ON MODERNIZATION AND NEW PLANT PROJECTS

WITH NEW ILLUMINATOR ON YARWAY FLAT GLASS GAGE . . .

BOILER WATER LEVEL Shines

It's light! It's bright! It's right! You see instantly the accurate boiler water level in your Yarway Flat Glass Gage because *the meniscus at water level stands out like a brilliant star . . .* thanks to the new Yarway Type "M" Illuminator.

The Type "M" Illuminator is specially-designed to give maximum brilliance to Yarway flat glass inserts, and to spot the water level over its entire traverse. The superior penetration of its blue-white light cuts through extraneous light, dust particles in the air, and deposits on the gage glasses. Effective over longer distances.

New or already-installed Yarway Flat Glass Gages may be equipped with the Illuminator. Yarway Illuminators may be installed in pairs on four-glass gages.

Get in touch with your nearest Yarway office for further details on this latest Flat Glass Gage development, or write direct to . . .

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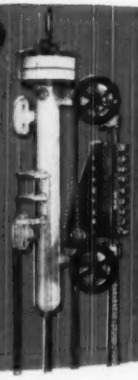
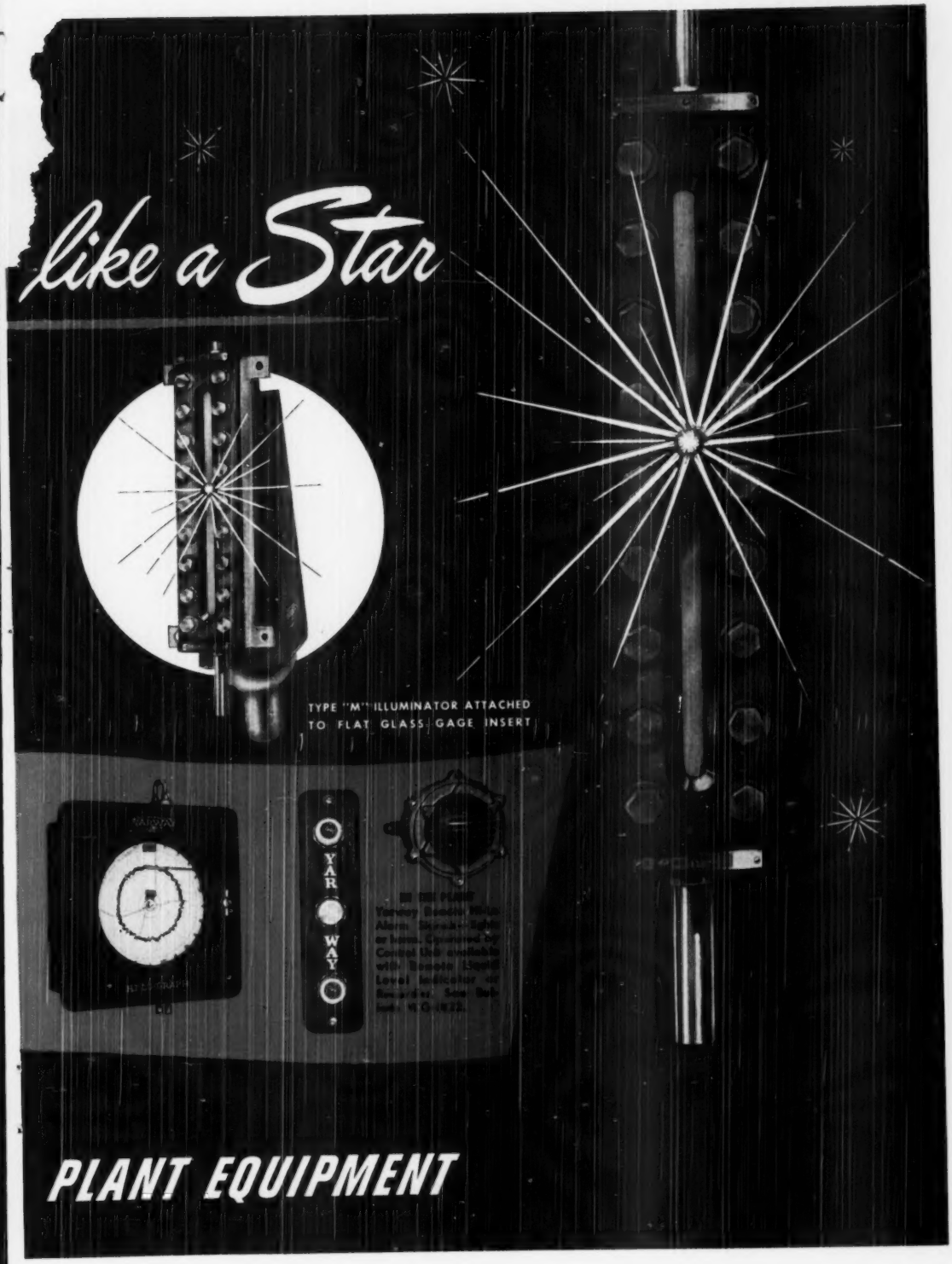
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

A COMPLETE YARWAY WATER LEVEL SYSTEM



YARWAY STEAM


like a Star
TYPE "M" ILLUMINATOR ATTACHED
TO FLAT GLASS GAGE INSERT
YAR
WAY
PLANT EQUIPMENT

America's first gas-turbine power plant for power generation is this General Electric 3500 kw unit installed at the Belle Isle Station of the Oklahoma Gas and Electric Co.

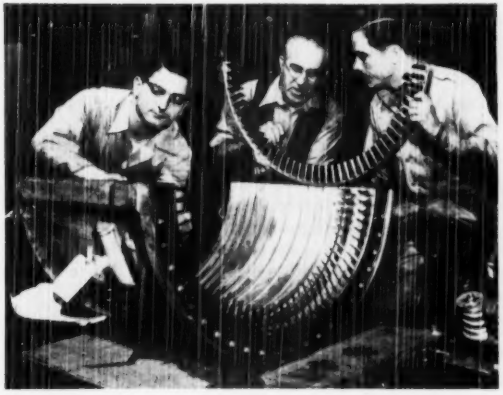
MORE Gas Turbines

AMERICA'S *New* PRIME MOVER

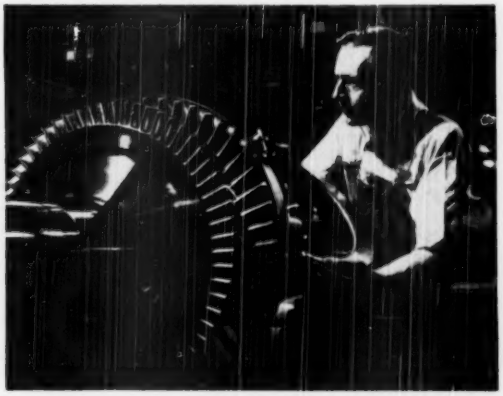
Three General Electric combustion gas-turbines—the first in America—have been placed in regular service. Full-scale production has begun on several basic designs, and in the next few months, more will be coming off the test stands in G.E.'s newly completed gas turbine factory.

The efficient, reliable and profitable performance record of the units already placed in revenue operation has established the gas turbine as an important prime mover. It offers several unique advantages: Each unit is a complete plant in itself. It is small and compact, easily operated, and requires but a minimum installation investment.

General Electric gas-turbine generators, rated 3500 kw and 5000 kw, are available to meet your requirements. They are backed by the experience that has given G-E steam turbines a position of leadership for more than 45 years. If you're interested in power generation, you'll want the facts about these new power plants. Write for your copy of bulletin GEA-5516, "Gas Turbine Power Plants," today. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



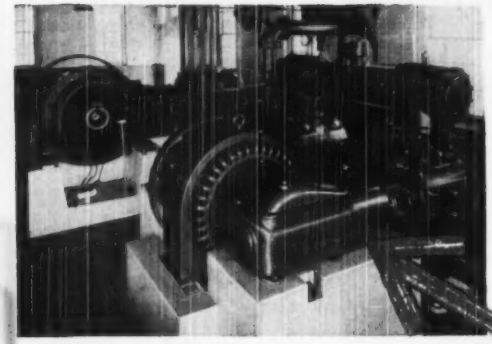
Assembling compressor casings requires the supervision of experienced craftsmen. While many manufacturing experts will "grow up" with gas turbines, responsibility for producing the first units falls on the shoulders of men who have spent years building steam turbines, turbosuperchargers, and jet engines.

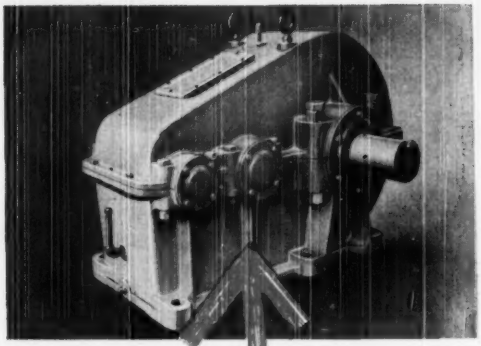


Though gas turbines require many components which may be new to the power engineer, the heart of the unit is still the familiar turbine wheel. Designed on principles established by steam turbine experience, this two-stage turbine rotor is given a final micrometer inspection before assembly in a new power plant.

GENERAL ELECTRIC

254-44





For the best lubrication use SINCLAIR RUBILENE

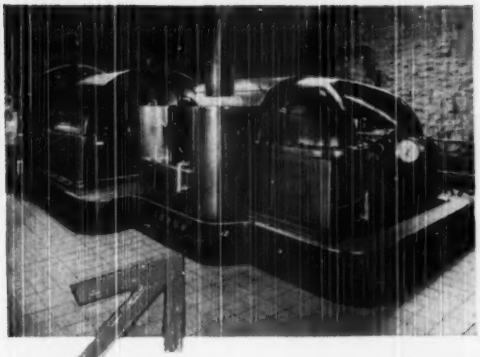
Over many years engineers in power plants throughout the country have accepted Sinclair's Rubilene as the finest available lubricant for power house equipment.

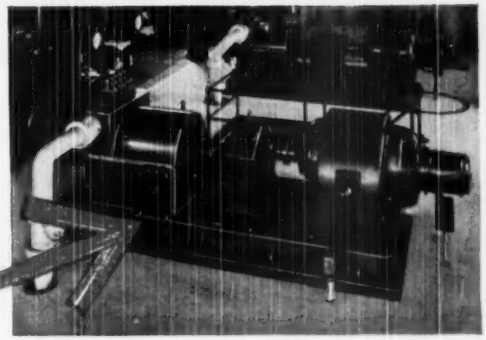
Sinclair Rubilene has always been a top-quality oil, as it has been constantly improved through the years, incorporating the latest technological developments in refining and processing. It resists oxidation under continuous high temperatures, and recirculation. It separates rapidly from water and is non-foaming. Through long periods of use it retains its original qualities, providing uniform, trouble-free lubrication and low maintenance costs.

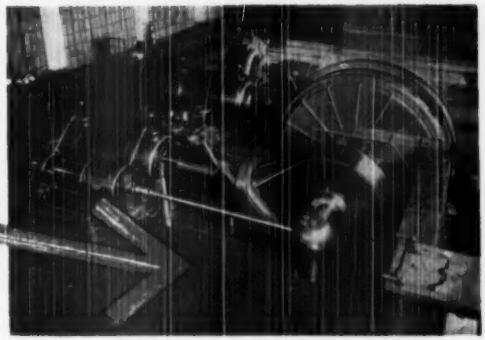
Yes... Rubilene's finer quality pays dividends in the power plant.

SINCLAIR

For lubrication counsel . . . see your nearest



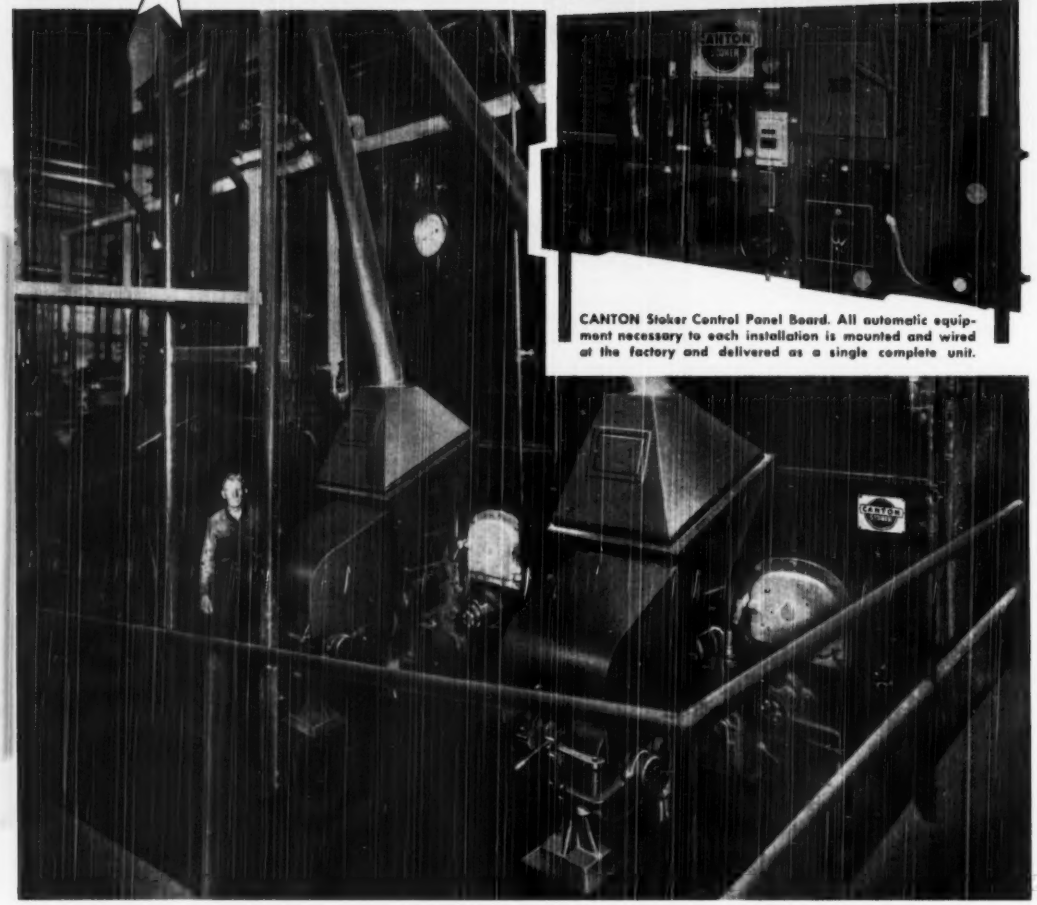




REFINING COMPANY

Supplier of Sinclair Products or write to Sinclair Refining Company, 630 Fifth Ave., New York 20, N. Y.

It's No Trick to Save Money



CANTON Stoker Control Panel Board. All automatic equipment necessary to each installation is mounted and wired at the factory and delivered as a single complete unit.

Multiple installation of CANTON Vulcan Ramfeed Stokers under 300 HP Water Tube Boilers at Utah State Capitol Bldg., Salt Lake City, Utah.

CANTON

SINCE 1910

...with a GOOD STOKER!

CANTON STOKERS

During the past forty years, thousands of users have learned that the superior construction and operating features of Canton Stokers provide worthwhile savings. Their dependable and efficient operation is backed by forty years' experience in designing and manufacturing quality stokers with outstanding advantages.

★ Every Canton Stoker is mechanically designed and engineered to give the highest possible operating efficiency for the specific installation in which it will be used.

★ All component parts of Canton Stokers are made of the finest materials—designed, manufactured, assembled, and tested under the rigid Canton "quality-production" policy.

★ Canton manufactures 54 types and sizes of Ramfeed and Wormfeed Stokers to supply a broad range of application requirements. Ramfeed Stokers are equipped with either single or double side-dumping Ash Plates. Wormfeed Stokers are supplied in either dead-plate or side-dumping types.

★ Canton maintains a complete stoker service and parts organization, available any time, anywhere to assure operators a minimum of "down-time" for their stoker equipment.

In addition, the "plus" advantages of substantial fuel and labor savings made possible with Canton Stokers will demonstrate why thousands of users are "sold" on Canton Ramfeed and Wormfeed Stokers for all types of power generating and heating plants.

CANTON STOKER CORPORATION
Andrew Place, S. W., Canton, Ohio
CANADIAN REPRESENTATIVE: Volcano Ltd., 743 Mountain Street, Montreal 3, Quebec
EXPORT DIVISION: W. B. Harkins, 751 Drexel Building, Philadelphia 6, Pa.

For detailed information on Canton Stokers, call or write the Canton Stoker representative nearest you or Canton Stoker Corporation, 741 Andrew Place, Canton 1, Ohio. *Bulletins on Request.*

Overhead-feed installation of three CANTON Vulcan Ramfeed Stokers at the Magnavox Company, Fort Wayne, Indiana.

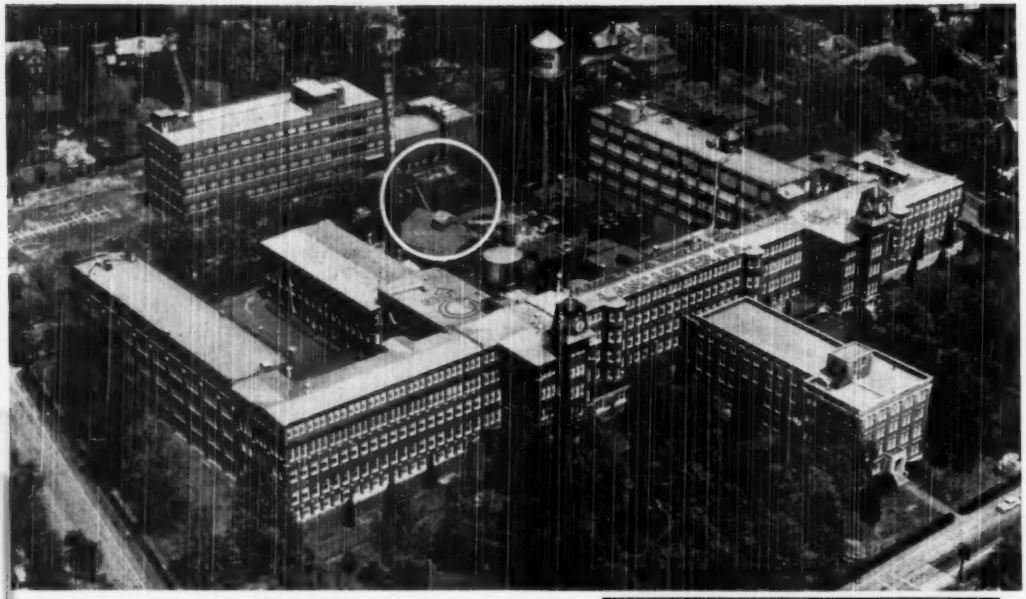
CANTON Lo-Set Stoker with Uniflex Drive showing Synchronized Combustion Control connections, Victor Silk Hosiery Mills, Doylestown, Pa.

Battery of four CANTON Duraflex Wormfeed Side-Dump Stokers at U. S. Post Office, Buffalo, New York.

CANTON RAM FEED STOKER DRIVE MECHANISMS ARE GUARANTEED FOR FIVE YEARS

STOKER

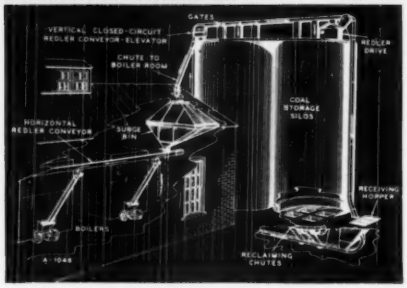
CANTON STOKER CORP. CANTON 1, OHIO



Feeding the Boilers at the big Hamilton Watch plant

Take another look at the above photograph of the huge Hamilton Watch Company plant at Lancaster, Pa. Note the little circle. Within that relatively small area is the compact REDLER coal handling system installed by Stephens-Adamson. . . . Little but mighty! Compact but highly efficient, this REDLER conveyor-elevator system feeds the boilers of the great precision plant in which "*The Watch of Railroad Accuracy*" is so meticulously manufactured.

In talking over *your* needs with an S-A Engineer you can be assured he is free to recommend the unit or combination of units best suited to your plant conditions—because Stephens-Adamson makes all types of bulk materials handling equipment. What is your problem? Write us today.



Coal is delivered to hopper at base of twin storage silos. Vertical, closed-circuit REDLER conveyor-elevator completely encircles silos. Lower run of casing is in tunnel underneath. Coal elevated up silo side, discharges into storage through chutes. Coal also can be delivered to boiler house by gravity through chute from elevating run to fill surge bin under boiler-house roof. A 42-foot-long REDLER conveyor picks up coal from surge bin and delivers to gate-controlled discharge spouts spaced to feed a series of stoker hoppers. Coal is reclaimed from silos by opening gate-controlled chutes which feed coal back into lower run of elevator.

STEPHENS-ADAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

Get All-Around Motor Protection with

SAFETY-CIRCLE

THAT SOLID CAST IRON FRAME protects *Safety-Circle* working parts against physical damage from every angle. The completely enclosed bottom provides extra protection and extra strength. End brackets are drip-proof at no premium.

Because the frame is cast iron, it is resistant to rust and corrosion. It withstands physical abuse and will not distort.

Protected Inside, Too

Safety-Circle protects against internal breakdown with multiple-dipped and baked stator and die-cast aluminum rotor. *Ball bearings are factory-lubricated and need no attention for years.* Wide open internal construction and large fans keep temperatures well within rated limits.

Don't be satisfied with a motor that gives you less than full protection. Insist on the extra protection of *Safety-Circle.*

For complete details on *Safety-Circle* advantages, see your A-C Authorized Dealer, Sales Office, or write for Bulletin 51B6210B. Sizes from 1 to 20 hp, 326 frames and smaller.

A-3145

Safety-Circle, Texrope and Vari-Pitch are Allis-Chalmers trademarks.

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MILWAUKEE, WIS.

ALLIS-CHALMERS

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by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

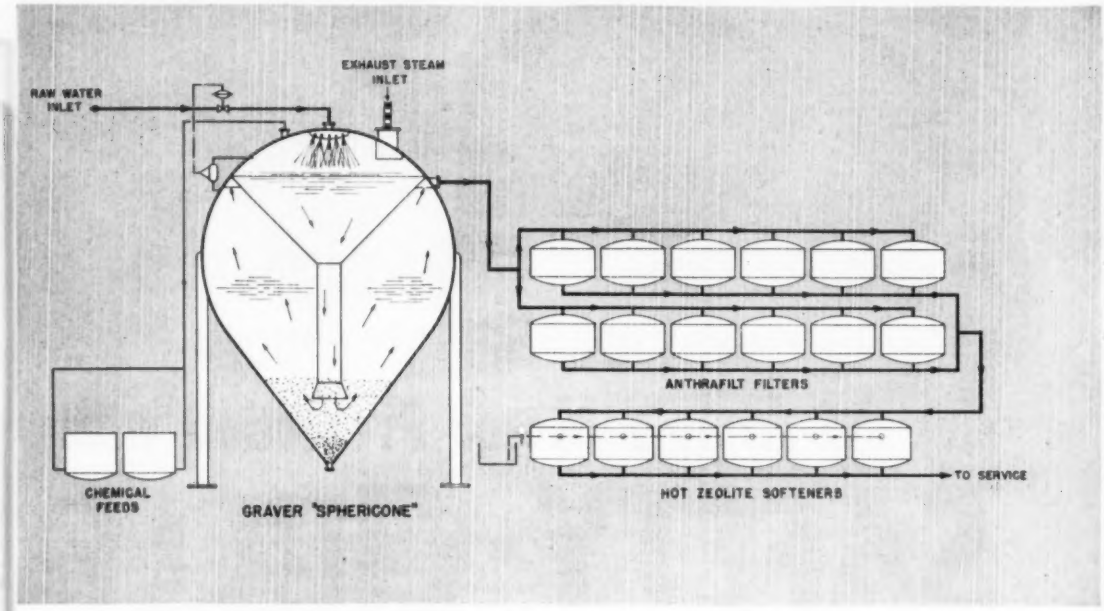
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

World's

Hot Process-HOT ZEOLITE



Facts about the GRAVER equipment in this plant

- One GRAVER SPHERICONE Hot Process unit 43 ft. 6 in. dia. x 60 ft. high
- Six GRAVER Hot Zeolite Softeners, each 10 ft. dia. x 5 ft. 6 in. high.
- Twelve GRAVER Anthrafilt Filters, each 11 ft. dia. x 5 ft. high.
- GRAVER Chemical Feeders

GRAVER

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

216 WEST 14th STREET, NEW YORK 11, N. Y.

Largest
PLANT...by GRAVER

WHEN a large eastern refinery wanted the most modern, efficient and economical treating system to handle 200,000 gph of feedwater . . . virtually 90 to 100% make-up . . . for their 650 psig boilers, their engineers selected a GRAVER Hot Process–Hot Zeolite plant employing GRAVEX styrene zeolite.

ADVANTAGES of this type of Water Conditioning System

This Graver water treatment with hot zeolite was chosen because it offered these advantages over a hot process softener with hot phosphate after-treatment:

1. **Lower hardness in feedwater.**
2. **Lower CO_2 in steam because of lower alkalinity.**
3. **Lower chemical operating costs.**
4. **Low silica in feedwater.**
5. **A uniformly low hardness in feedwater with possible rapid variations in raw water composition.**

The plant includes a single GRAVER SPHERICONE Hot Process Sedimentation Tank . . . also the largest in the world . . . to handle the entire water supply. This exclusive tank design gives greatest clarity of effluent, and at the same time provides greatest economy in steel and manufacturing cost.

GRAVER EXTRAS

- GRAVER chemical engineers and water-conditioning specialists cooperated with the Company's engineers in designing the plant layout.
- A GRAVER pilot plant pre-tested the zeolite.
- All major component parts of the plant, including the hot process, filter and hot zeolite tanks are being fabricated in GRAVER'S own shops.

Write for further information on the application of this type of GRAVER Water Conditioning system to your own feedwater needs.

GRAVER

GW 429

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

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Sweet's File

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1950

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equipment?

reach for Sweet's . . . All these manufacturers' catalogs, covering material handling equipment, power transmission equipment, measuring and controlling equipment, pumps, compressors, pipe, fittings, valves, traps, and a host of miscellaneous equipment and supplies, are instantly available in Section No. 2 of your Sweet's File for Power Plants.

The other sections of this Sweet's File contain additional catalogs covering a wide range of materials and equipment—useful and up-to-date information on product forms, characteristics, performance and use.

This grouping of manufacturers' catalogs, in sections according to products or use of products, is made for your convenience, so that you can readily compare one product with another. Indexes of manufacturers, products and trade names lead you quickly and easily to the catalogs you are looking for.

Sweet's is working constantly to get more manufacturers to send you their catalogs in this easy-to-use form. If you fail to find what you want, please tell us.

Sweet's catalog service

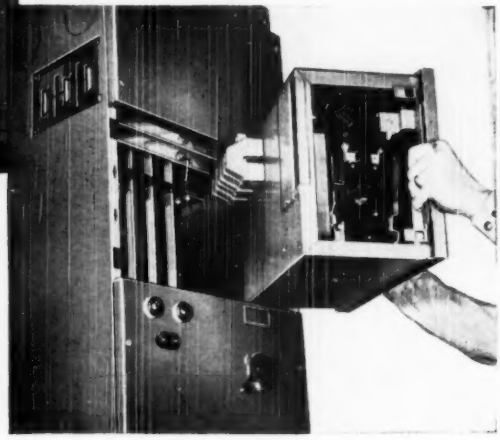
DIVISION OF F. W. DODGE CORPORATION

119 WEST 40TH STREET • NEW YORK 18, N. Y.

Announcing

Centr-A-Power

. . . custom-built . . . pre-engineered



New Features Save Floor Space, Speed Up Wiring, Facilitate Operation

LESS FLOOR SPACE NEEDED

Compact trough design allows more troughs to be used in a given area of floor space.

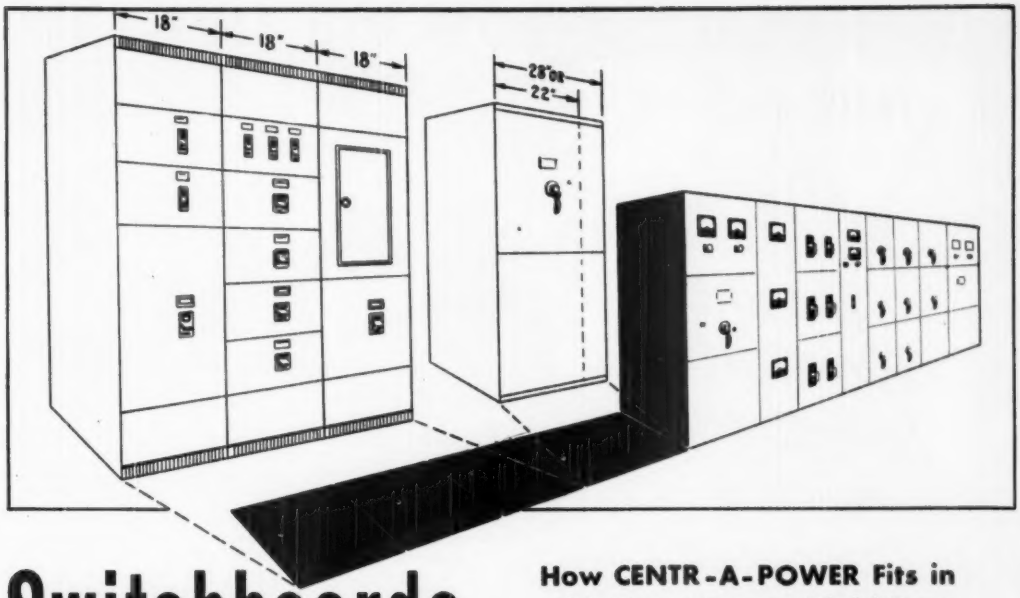
LOTS OF ROOM FOR WIRING

Generous (4 x 8 in.) wiring gutter makes wiring easier —can be accomplished with units in the trough—and allows use of over-size cable on long runs, keeping voltage drop low.

ACCESSIBLE FROM FRONT

CENTR-A-POWER Switchboards are completely accessible from the front, permitting aisle, back-to-back, "L" and "U" installations, further saving floor space.

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS



Switchboards

. . . at money-saving prices

To save you money on installation time and maintenance costs, Trumbull has designed a new type of switchboard for complete low voltage (600 V and under) switching requirements. Because of pre-engineering and standardization, you can now have the highest quality construction at the lowest possible cost. Here are some of the features:

Pre-fabricated, rigid steel troughs can be placed in any arrangement to provide a completely dead-front, totally-enclosed switchboard. Wiring gutter design is such that load wiring is isolated from incoming load bus. Compact switch or breaker units, called CENTR-A-PLUGS, are easily mounted or removed. A quick-clip attachment saves time in installation, inspection and maintenance. Self-aligning latches replace bolts and nuts. Positive connection to bus bars is assured by use of spring-loaded, reinforced stabs. Each CENTR-A-POWER unit self-contained and electrically isolated from adjacent units.

How CENTR-A-POWER Fits in with Your Present Rigid Type Switchboard Equipment

CENTR-A-POWER is made from three standard troughs, all 90 in. high. At left is unit type CENTR-A-POWER with 18 in. trough; it handles fusible switches through 200 amp. and circuit breakers through 600 amp. Two standard section troughs are indicated in the center. Type A is 22 in. wide, handles 400 and 600 amp. fusible switches. Type B is 28 in. wide, handles fusible switches through 1200 amp. and circuit breakers through 1600 amp.

Unit-Type Troughs (18 in.) are furnished assembled or unassembled. Large standard sections are furnished assembled only.

ASK ABOUT TRUMBULL CENTR-A-POWER CONTROL CENTERS

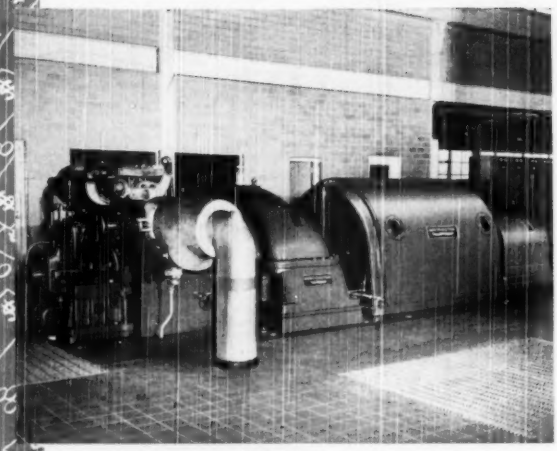
which are of similar construction and line up mechanically and electrically with CENTR-A-POWER Switchboards.

New Free Bulletin—Address The Trumbull Electric Manufacturing Company, Plainville, Conn. Ask for Bulletin TEB-3.

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

FACTS ABOUT THE *Most Profitable Turbine Generator Investment* YOU CAN MAKE...



One of two Worthington 4000 kw turbine generator sets installed in a mid-western municipal power plant, operating on 600 #G and 750 F.T.T. Steam exhausting to 28" Hg vacuum.

Worthington's Experience and Undivided Responsibility Assure Low Cost, Dependable Power

Builders of steam turbines for over 30 years, Worthington's Steam Turbine Division is backed by the experience and resources of the entire Worthington organization — recognized leaders in the power plant field for more than a century. In view of today's increased turbine pressures and temperatures — and the resulting needs for new and special materials — this vast, combined source of technical knowledge has proved of tremendous practical value in developing turbine design, construction and performance.

Generators Are Worthington's, Too

The generators used with Worthington Turbines are built by a Worthington subsidiary that has specialized in this field for over 45 years. This means that Worthington, as manufacturers of *complete* turbine generator units, assumes *undivided responsibility* for the coordinated design, assembly and performance of these units.

Before shipment, Worthington Turbines and Generators are assembled together *as units* for testing and adjustment — eliminating the necessity for doing this after installation. Also, for installation and service, Worthington turbine specialists and regular Worthington service men are always available from our District Offices throughout the country.

Check These Over!

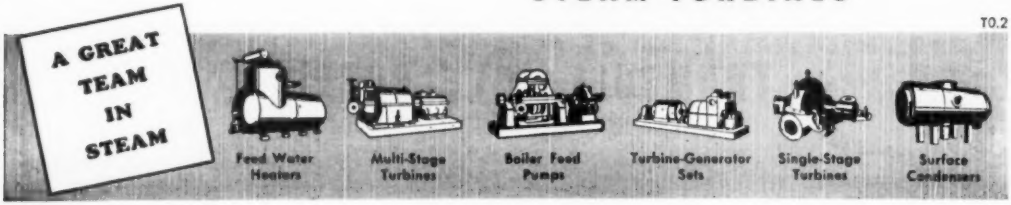
Adding up, Worthington's matchless power plant experience . . . huge manufacturing facilities . . . long specialization in both turbine and generator manufacture . . . undivided unit responsibility . . . and skilled technical service . . . are the best assurance you can get anywhere of efficient, economical steam turbine power.

Worthington makes turbines in a wide range of sizes and types, each one designed to make steam do more work. For details proving *there's more worth in Worthington*, contact your nearest Worthington representative. Or write to *Worthington Pump and Machinery Corp., Steam Turbine Division, Wellsville, N. Y.*

WORTHINGTON

STEAM TURBINES

TO.2



WHY THIS BIG IRONER GETS HOTTER, SOONER

There are 9 reasons—the 9 Yarway Impulse Steam Traps draining the 8-roll Hoffman installation in the all-Yarway-equipped laundry at Temple University Hospital, Philadelphia. The other Yarways are on tumblers, presses, water heater, etc.

In laundries and cleaning plants—as in all plants using steam equipment—profitable operation depends on equipment getting hot *quickly*, and *keeping continuously* at peak temperature for the full operating period.

Yarways do this by opening wide during heating-up period to discharge air and condensate *fast*. Then, when peak temperature is reached, the trap discharges heat-retarding condensate as it forms instead of waiting for quantities to accumulate. Result—maximum temperature . . . maximum operating profits!

Other Yarway features—only one moving part (a little valve), low maintenance, easy installation, low cost. More than 650,000 have already been installed.

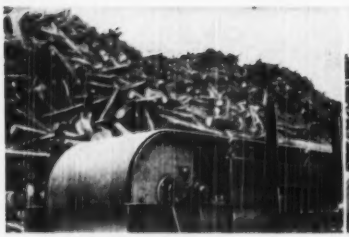
Yarways are sold by more than 200 distributors in the United States and other countries.

Install a Yarway on free trial in your plant. See your nearest distributor, or write to . . .

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

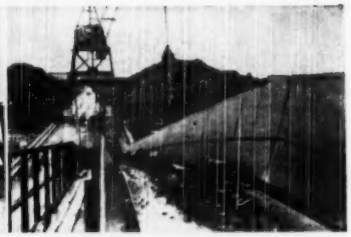
Stainless Steel Body

YARWAY IMPULSE STEAM TRAP

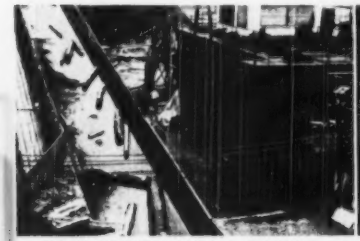


START OF THE SYSTEM is this 36"-wide Goodyear Style B Conveyor, operating on 900' centers, hauling logs from stock piles toward the mill.

TRAVELING GANTRY loads 4' log sections onto conveyor at various points along its length.



LOG CONVEYOR CLIMBS 30' from ground level, lifting logs toward transfer point where second conveyor, direct from river, also feeds belt leading into mill.



THREE GOODYEAR STYLE B CONVEYORS move logs from stock pile conveyors to chippers. Belts are 108', 62' and 75' on centers, 72" wide x 7-ply 42 oz. reinforced duck.

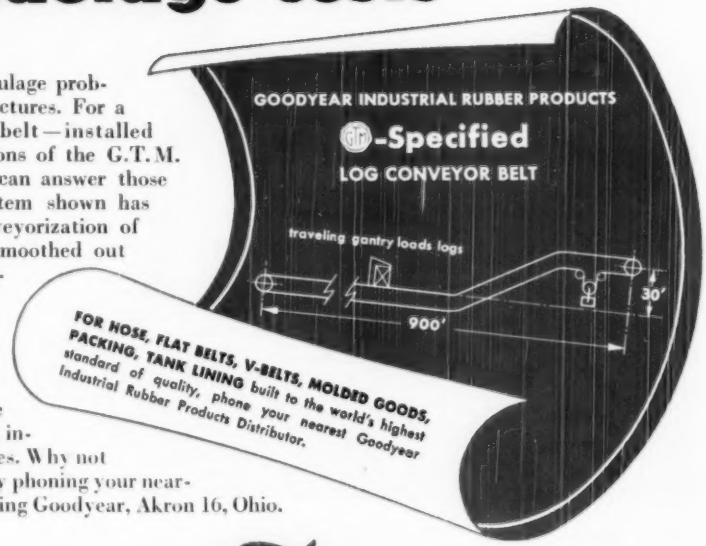
CHIPS RIDE THE "BELT LINE" from chippers to storage, then in constant flow as needed from surge pile to digesters. Belts are 48" x 4 ply synthetic construction.

SECRET OF THE STEADY FLOW OF CHIPS is this battery of surge bins, fed by chip-handling belt running through "bridge" at left. Belt not shown feeds digesters.

Belts beat down haulage costs

EVERY plant with an inside haulage problem can learn from these pictures. For a Goodyear in-plant conveyor belt—installed according to the recommendations of the G.T.M. —Goodyear Technical Man—can answer those problems just as the belt system shown has helped a paper company. Conveyorization of their log-handling operations smoothed out delivery of chips, lowered overall cost of handling of materials inside the plant.

Whatever the materials you move—logs or ore, coal or ashes —lower-cost handling can come with Goodyear Conveyor Belts, installed over long or short distances. Why not talk it over with the G.T.M.—by phoning your nearest Goodyear distributor, or writing Goodyear, Akron 16, Ohio.


GOODYEAR INDUSTRIAL RUBBER PRODUCTS
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LOG CONVEYOR BELT
traveling gantry loads logs
900'
30'
FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.

GOODYEAR

THE GREATEST NAME IN RUBBER

D-C POWER AT *Lowest cost ever*

WITH NEW G-E PUMPLESS RECTIFIER

The first large (750 kw and above) rectifier without a vacuum pumping system

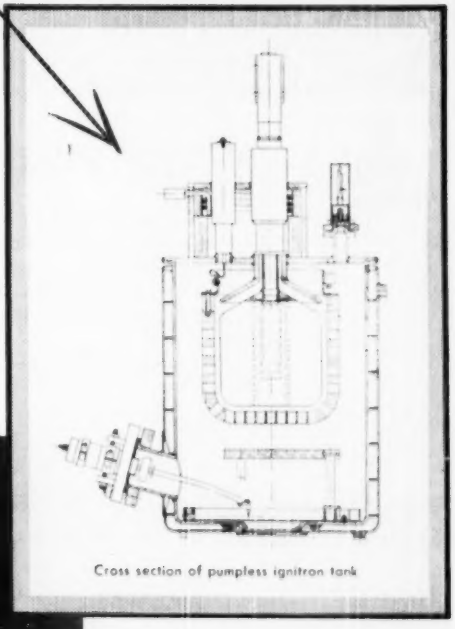
IT GIVES YOU

Improved Performance at full or partial load with low no load losses, no vacuum-pump losses.

Lower Maintenance Cost—manifolds and pumps are eliminated, fewer rotating and moving parts to replace, momentary overloads easily and safely handled.

Easier Installation with inter-connections furnished is a new packaged design with size and weight slashed. Up to 25% savings in installation costs.

You can cut your power bills with G-E Mercury Arc Rectifiers. Call or write your nearest G-E sales office for information. Apparatus Department, General Electric Co., Schenectady 5, N. Y.



Cross section of pumpless ignitron tank

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A BETTER PUMP FOR OIL BURNERS

There's no other pump quite so satisfactory as the IMO for oil burner service because there is no other pump built just like the IMO — the only positive displacement, rotary pump with no vanes, valves or pilot gears.

The IMO can be direct-connected to high speed motors or turbines; it requires no reduction gearing; occupies but little space; and operates smoothly, quietly and efficiently.

For your next oil burner job be sure of the best . . . specify the new low cost IMO A313A.

Bulletin I-160-P.

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DE LAVAL STEAM TURBINE CO., TRENTON 2, N. J.

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TURBINES • HELICAL GEARS
CENTRIFUGAL BLOWERS AND COMPRESSORS • CENTRIFUGAL PUMPS • WORM GEAR SPEED REDUCERS • IMO OIL PUMPS

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POWER

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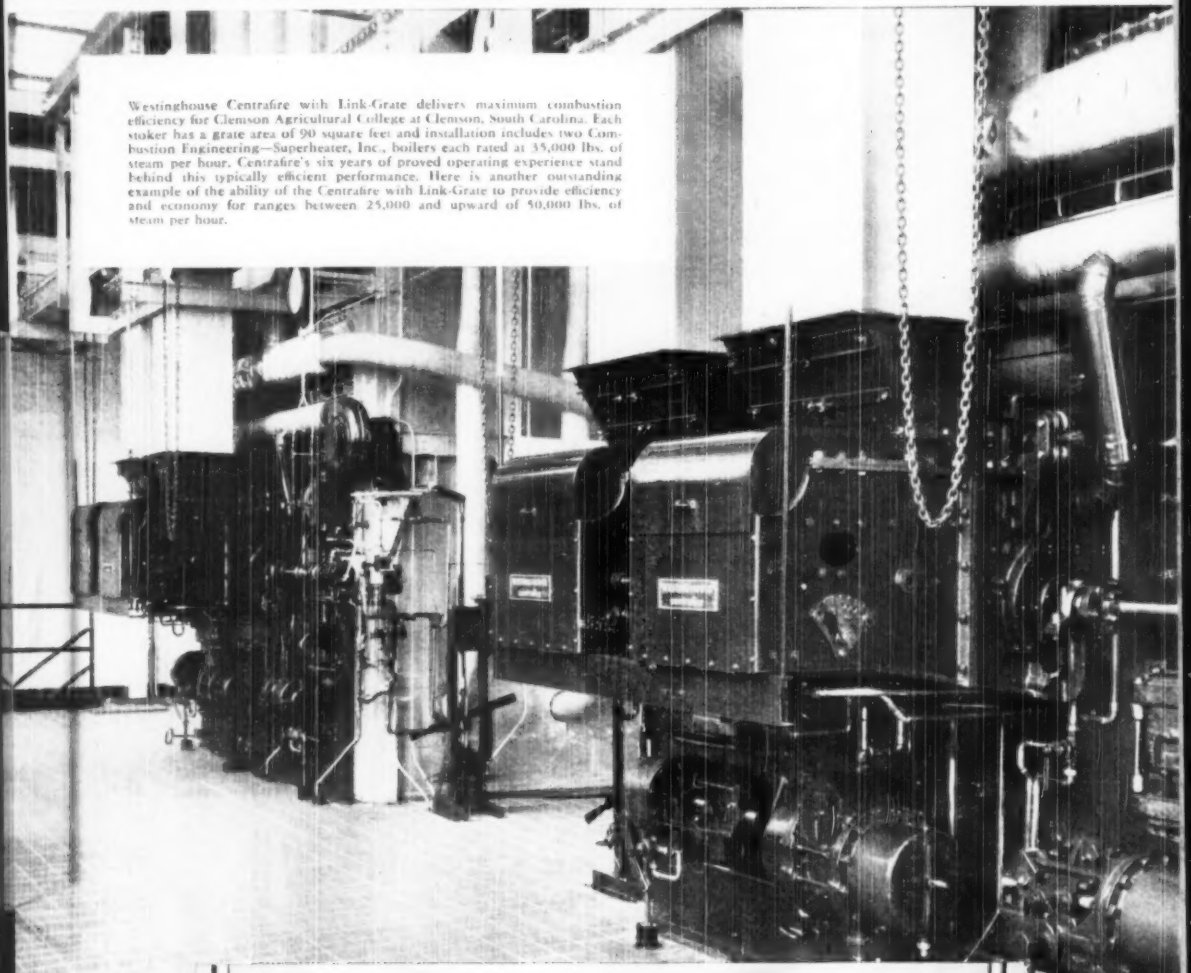
YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Westinghouse Centrafire with Link-Grate delivers maximum combustion efficiency for Clemson Agricultural College at Clemson, South Carolina. Each stoker has a grate area of 90 square feet and installation includes two Combustion Engineering—Superheater, Inc., boilers each rated at 35,000 lbs. of steam per hour. Centrafire's six years of proved operating experience stand behind this typically efficient performance. Here is another outstanding example of the ability of the Centrafire with Link-Grate to provide efficiency and economy for ranges between 25,000 and upward of 50,000 lbs. of steam per hour.



High Thermal Efficiency

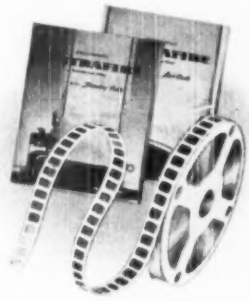
comes in small packages, too!

Centrafire with Link-Grate is specifically designed for capacities ranging from 25,000 to upward of 50,000 lbs. of steam per hour. Unique spreader-type firing and continuous Link-Grate action provide traveling-grate performance at considerably less initial cost. Centrafire's years of proved operating experience are your assurance of its ability to deliver maximum combustion efficiency. The design and construction refinements that make this efficiency possible are built in, not added as extra accessories.

Link-Grate motion keeps the burning fuel in constant progression, forming a porous bed that burns evenly and thoroughly. An undulating wave-like motion keeps ash accumulation small in size. Coal is not spread over the ash-discharge section. Ash is discharged without interruption of fuel feed or air flow.

Before making another stoker investment, be sure you have complete information about Centrafire with Link-Grate that gives you these proved points of superiority: Discharges ash without reduction of capacity . . . Precisely arranges fuel, air and gases for high thermal efficiency, maximum combustion . . . Feeds coal evenly . . . Fires any grade of bituminous coal . . . Distributes coal uniformly . . . Basement not required; ash can be collected on same level.

J-50514



GET THESE FACT-PACKED BOOKS: The complete Centrafire story, including performance facts and economy figures.

CENTRAFIRE with Link-Grate, B-3890-A
CENTRAFIRE with Traveling Grate, B-4553

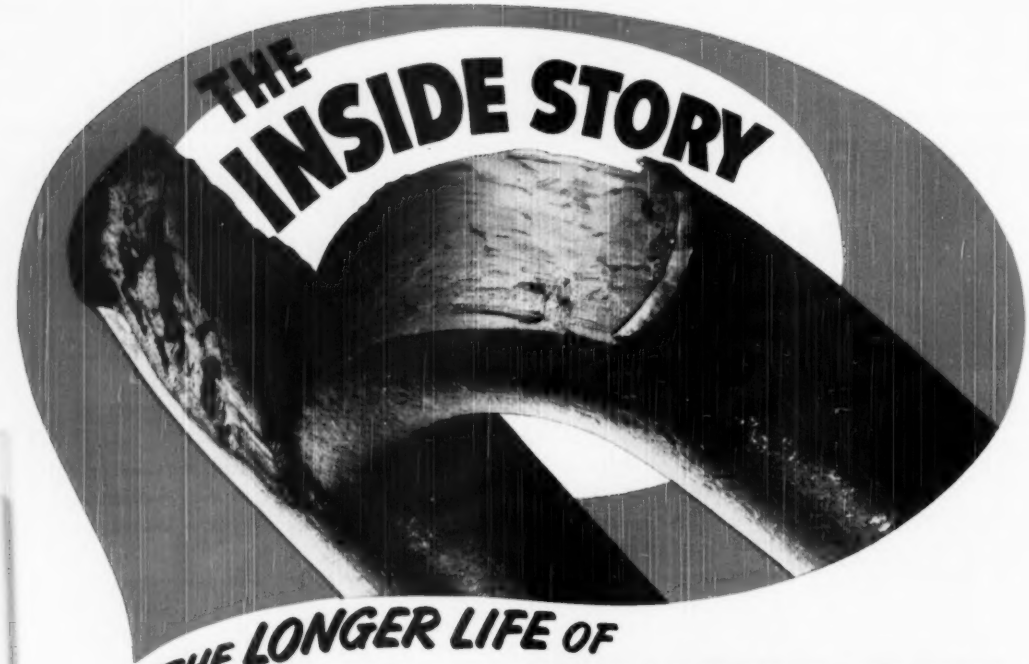
Write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

SEE LINK-GRATE MOVIE IN YOUR OWN OFFICE

A 10-minute, 16-mm. sound movie that gives visual proof of Centrafire's ability to deliver precision combustion. Call your nearest Westinghouse Steam Specialist for a showing.

Westinghouse

STOKERS

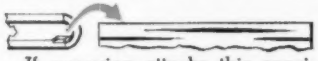


OF THE LONGER LIFE OF BYERS WROUGHT IRON

Every engineer will recognize this picture as a notch-fracture test specimen . . . and will appreciate the unusual physical properties suggested by the break.

The hickory-like fracture results from the unique structure of wrought iron. Tiny threads of glass-like silicate slag, 200,000 to 250,000 per square inch of section, are distributed through a matrix of high-purity iron. This fibrous structure, which might be compared to that of a stranded wire cable, equips wrought iron to withstand sudden shock, and to resist fatigue induced by continuing vibration.

Of even more importance in the average application is the *corrosion resistance* of wrought iron . . . which also comes directly from the unique structure and composition of the material. If a small section of wrought iron were placed under a microscope, a few of the multitude of silicate slag fibers would show up as in this sketch.



If corrosion attacks this specimen, it would first cover the entire surface . . . then concentrate at one point, and work inward. Soon it would encounter one of the slag fibers . . . and since this fiber is unaffected by corrosion, the inward march would be halted. This action is shown by this sketch.

Corrosion is now "detoured." It works right and left, until it comes to the end of the fiber, when it may start to work inward again. The process is repeated when the second line of defense is encountered. Pitting, and rapid penetration of the metal, is discouraged. Useful life is determined by how long it takes for corrosion to reduce the entire body of metal to its safe limit of thickness, rather than by how long it takes corrosion to perforate the wall at a few vulnerable points. The fibers also anchor the initial protective scale, which shields the underlying metal.

Every cost sheet today confirms the fact that the most expensive material you can use is that which must be replaced too soon—and too often. The extra service of wrought iron is helping tens of thousands of users to cut maintenance costs. We will welcome an opportunity to review your piping problem with you—and to recommend the places where wrought iron—on the basis of its past performance—can be profitably used. Ask for our booklet, "THE A B C'S OF WROUGHT IRON."

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, San Francisco. Export Division: New York, N. Y.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP SWAIN, EDITOR • OCTOBER 1950 • ESTABLISHED IN 1882

Will You Be a Juror?

THE DISCUSSION STIRRED UP by George Edwards in his April piece on instruction books keeps boiling along. We're getting a lot of good arguments on both sides, but as long as that's all we get, nothing much is going to come of it. How can we turn some of this heat into light, put some of this thinking onto the job of spotting specific shortcomings in manufacturers' manuals and showing how they can be made more valuable to the man in the plant who has to use them?

Well, we'd like to propose a plan to do just that. For it, we need cooperation from manufacturers, on the one hand, and from practicing power engineers, on the other. We've already received offers of help from several equipment builders who are interested in this question. And we know that you power engineers will pitch in when you see an opportunity to do a good turn for yourselves and your fellow engineers.

Let's take a look at the idea and then you'll see where you come in. When we published J B McMahon's reply to George Edwards (p 121, June) we asked if some manufacturer would be game to try an experiment with us—let us publish part of an instruction book in POWER and see what you, our readers, thought of it.

We stuck our neck out, you see. Well, it wasn't long before we had company. Our old friend Norm Jacobson of Allis-Chalmers sent several examples on which they had labored long to turn out a good job for the user—instruction books on switchgear, circuit breakers and voltage regulators.

Not far behind him came Arthur Patureau with copies of instructions on the Fischer & Porter Co's ratio controller. And P E Madden with manuals on the operation of P E Madden & Co metering pumps. So there is no lack of interest on the part of equipment builders, and no lack of willingness to take any critical potshots that may come along.

We'd originally suggested publishing part of a typical instruction book in POWER. On looking over the manuals sent to us for that purpose, we soon saw that this scheme wouldn't work. A sample from one manual just wouldn't give the whole group a fair shake. And, of course, we couldn't turn over a full issue just to this question, important though it is. Trying to figure out the best way to handle this, we worked our way through to the jury idea that gives this editorial its title.

Let's put some of these manuals, complete, in the hands of a jury of experienced power engineers, said we, and see what this sample of the engineering fraternity thinks of them. With enough jurors, and enough instruction books scattered among them, we can get a fair idea of where they succeed and where they fail. Such specific information will make it possible for equipment builders to develop ever more readable and useful instruction books and so, in turn, will make your job of operation and maintenance easier and more rewarding. That's why we know you'll help out on this project.

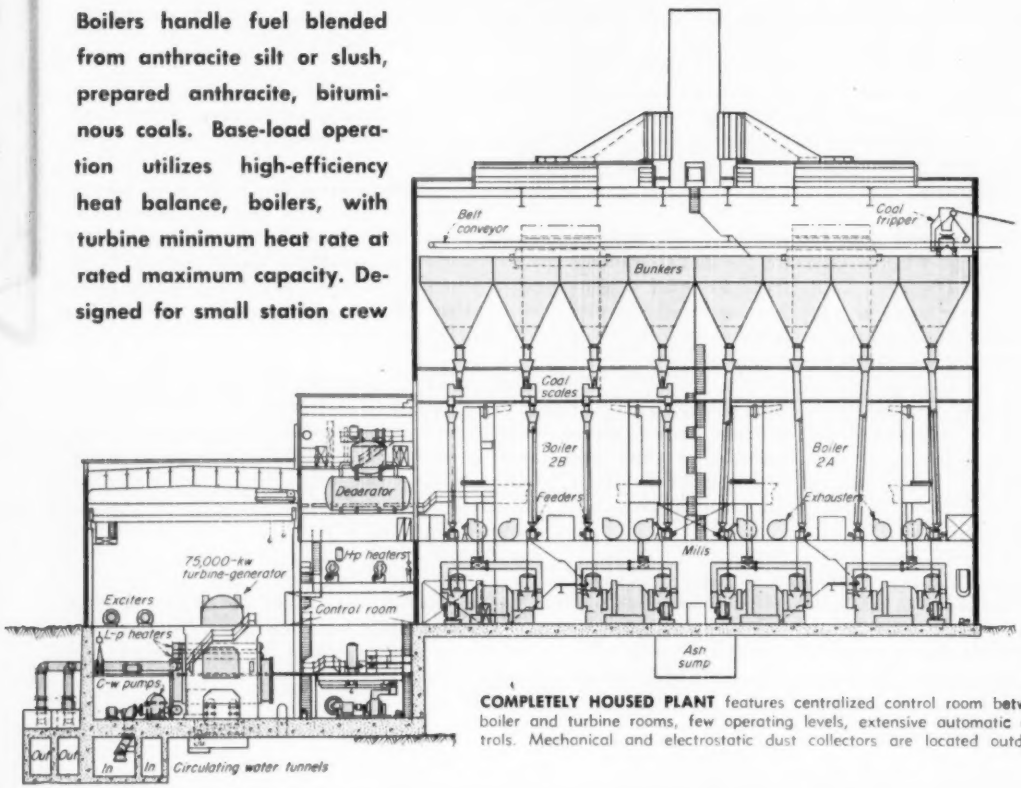
How can you do your part? Just drop us a note saying you're willing to serve on POWER's instruction-book jury. Add a line or two telling us what kind of power equipment you're experienced on, so we can send you an instruction book that's down your alley. You'll only be asked to comment on one manual and we'll make it convenient for you by sending along a handy form to follow in saying what you think.

The manufacturers have shown they're game to stand your fire. Who'll come forward from the plant side of the discussion and invest a little time in a job that will benefit all of us?

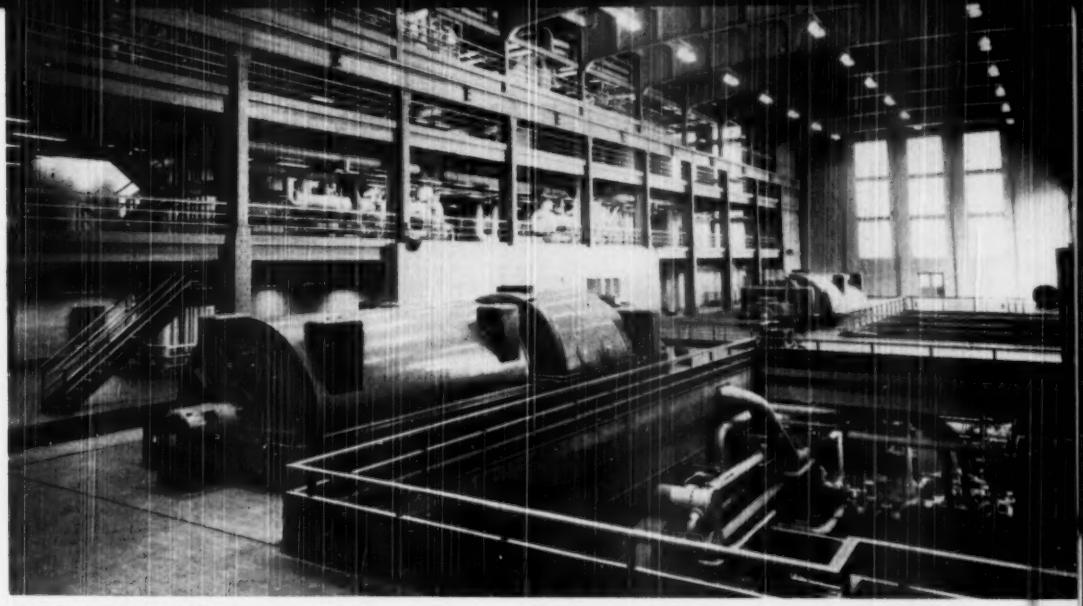
SUNBURY'S EXTENSIVE GROUNDS include, *l* to *r*, railroad yard, thawing shed, coal storage, coal-handling system, office and service building, water-treating plant, main plant, water-intake house, dam in Susquehanna River to prevent recirculation. Area in front of plant accommodates 66-kv switch yards and control house. Ash-disposal area is at lower right

SUNBURY Station Geared to Burn

Boilers handle fuel blended from anthracite silt or slush, prepared anthracite, bituminous coals. Base-load operation utilizes high-efficiency heat balance, boilers, with turbine minimum heat rate at rated maximum capacity. Designed for small station crew



COMPLETELY HOUSED PLANT features centralized control room between boiler and turbine rooms, few operating levels, extensive automatic controls. Mechanical and electrostatic dust collectors are located outdoors



PRESENT TURBINE ROOM houses two 75,000-kw tandem-compound double-flow 3600-rpm turbine-generators taking steam at 1250 psig, 950 F. Central control room, at *left*, between turbine ends occupies space in heater bay at common boiler-turbine floor level. Exciters for main generators, separately driven, are located on this floor, at the extreme right

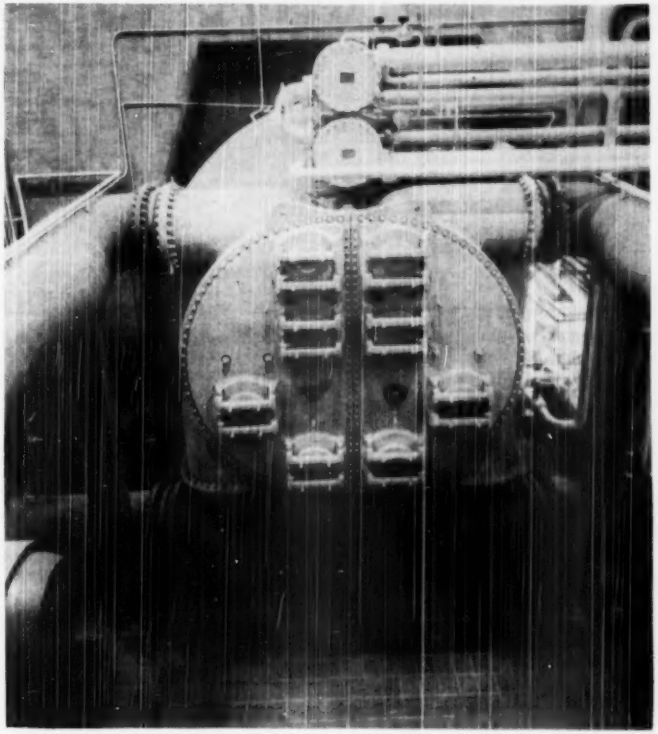
Mixed Coals

► Pennsylvania Power & Light Co placed Unit No. 2 at Sunbury Station in service on Sep 19, 1949 and Unit No. 1 on Nov 7, 1949. This new plant near Sunbury, Pa., burns pulverized anthracite as the principal fuel. Two 400,000-lb-per-hr 1350-psig 955-F steam generators serve each of the 75,000-kw units. They are completely interconnected.

Station features include (1) complete water-treatment plant, which will be detailed in a later article (2) built-in connections for boiler acid cleaning (3) closed cooling-water system for hydrogen, lubricating oil, i-d fan and pulverizer bearings, etc, coolers with spare heat exchanger for cleaning operation (4) duplicate auxiliary equipment for critical services.

The 20,000-lb-per-hr makeup evaporators receive preheated, zeolited, deaerated water and send their vapor into the heat-balance system through a bubble washer supplied with condensate from a small reflux condenser.

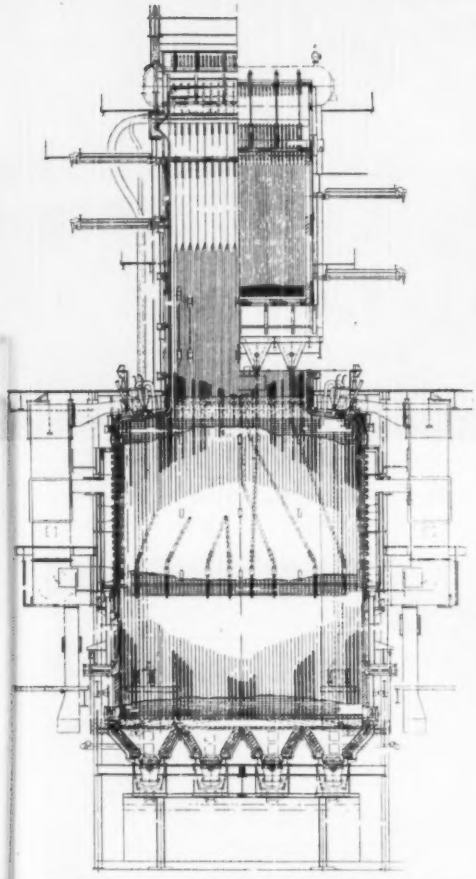
Shallow river depth at the station has led to building a 5-ft-high dam just below the circulating-water intake house to prevent recirculation during low-water periods. The river supplies all station water services, cooling, make-up, sanitary and drinking.



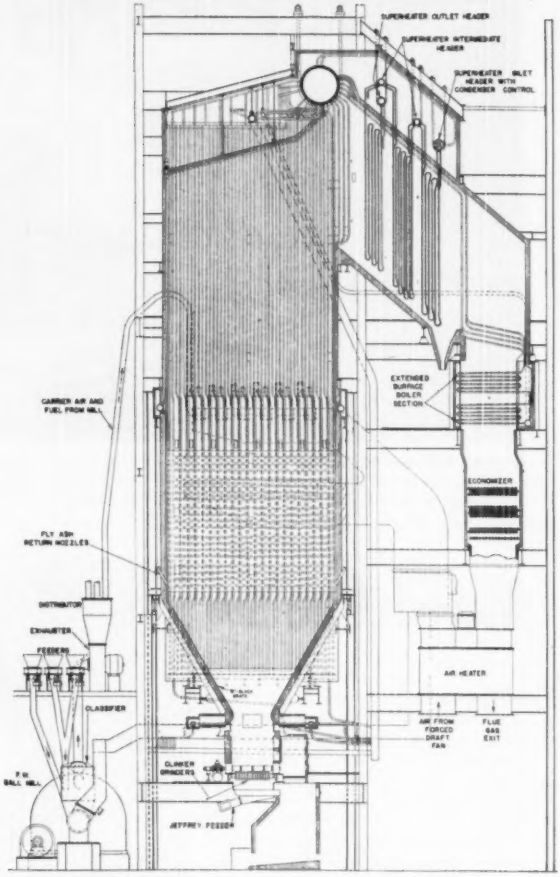
TWO-PASS MAIN CONDENSER with 42,500-sq-ft surface serves one 75,000-kw turbine. Divided waterboxes may be supplied by either one or two circulating-water pumps. Two lowest-pressure heaters for unit are mounted in extended condenser neck

For more data on Sunbury, turn page

PULVERIZED-ANTHRACITE FURNACES FEATURE LOW HEAT RELEASE



SIX BURNERS IN EACH SIDEWALL ARCH fire downward in furnace. Sidewalls above hopper are protected by refractory tile, which also contains the secondary-air admission ports



SIX FEEDERS ON EACH MILL blend coals to limit the combined ash and moisture content. Extended boiler surface section follows superheater in the rear-boiler gas passage

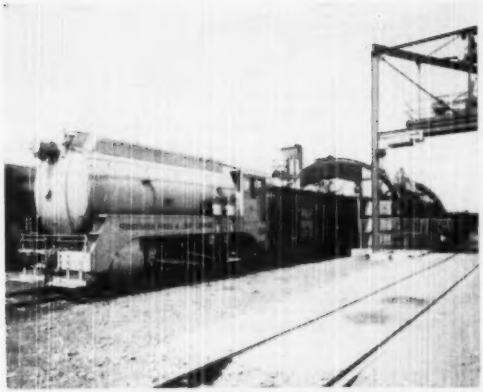
Steam Generators. These four units (*cross-section above*) are the largest units burning pulverized anthracite. Two ball-and-tube-type pulverizers serve 12 burners on each furnace. Three fuels, (1) anthracite silt (2) prepared No. 5 buckwheat anthracite (3) bituminous, are blended in the mills before firing. The silt-ash content varies from 16 to 50%. Bituminous coal augments oil torches in lighting off, mixes with the silt as a drying agent when moisture runs too high and serves as emergency fuel should anthracite become unavailable.

Heat release at maximum continuous rating is only 8520 Btu per hr per cu ft. All watertubes below the burner arches are tile covered, except the hopper slopes, to limit the amount of cooling. The side walls contain air-admission ports formed by tile shapes.

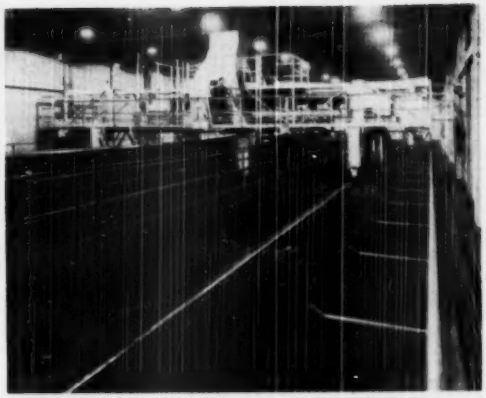
Flue dust from pulverized-anthracite burning usually contains a considerable amount of carbon. Facilities are provided for returning dust collected in multiple-cyclone dust separators and hoppers below the superheaters to ash-bed surface in furnace for reburning. About 10 ft or more of ash is maintained in the furnace bottom. Air at pressures up to 10 psig flows through the ash bed to reburn carbon in flue dust.

Superheat control depends on flow of feedwater through a condenser in the superheater inlet header. After flowing through the boiler-regulating valve, part of the feedwater flows to the economizer, and a smaller portion through the superheat-control condenser and then into the drum.

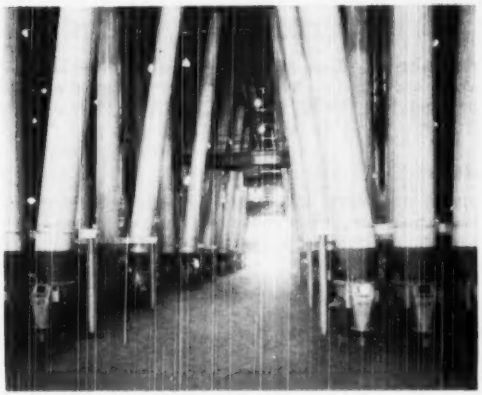
Low gas velocity through boiler superheater and economizer prevents cutting of tubes by dust-laden combustion products. Magnetic couplings on induced-draft-fan drives have the double advantage of minimum power consumption and avoiding fan-blade erosion by low rotor speed for all gas flows. Mechanical and electrostatic dust separators in series precede the induced-draft fans.



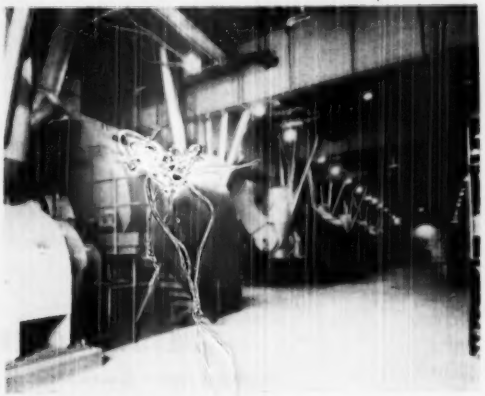
TWO 600-PSIG ACCUMULATOR LOCOMOTIVES handle coal cars in railroad yard. Car dumper handles 20 cars per hr each gondola car delivering 70 tons. Coal samples taken here



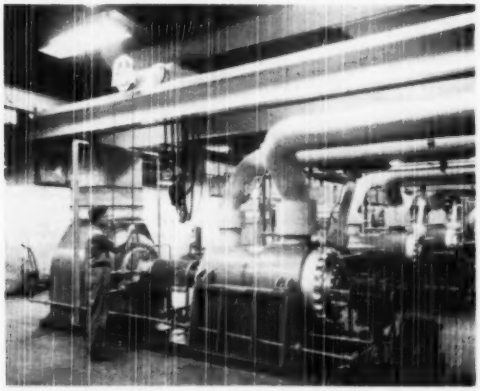
TRAVELING COAL TRIPPER serves five rows of bunkers with a total of 40 pockets. Two outer bunkers hold prepared anthracite; next two, anthracite silt; middle bunker, bituminous



COAL-FEEDER FLOOR has vertical downtakes from bunkers above. Six feeders adjust the rate of flow of three different coal types to each of eight coal pulverizers on floor below



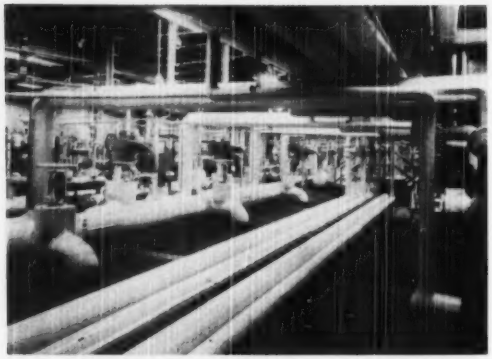
TWO HORIZONTAL BALL MILLS serve each of four boilers. Each mill has two exhausters to increase over-all availability. Balls of different materials are being tried experimentally

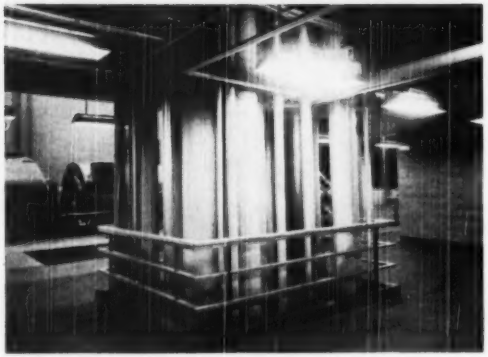


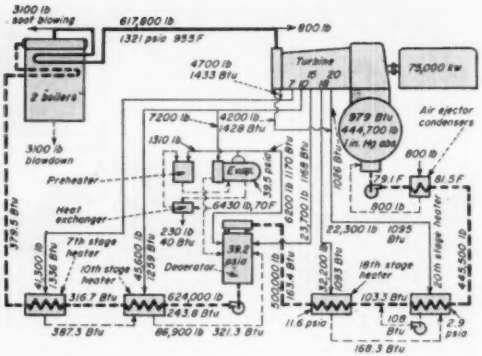
BOILER FEED PUMPS are all driven by totally enclosed 1250-hp motors. Monorail crane, above pumps, facilitates maintenance and repair. Feedwater systems are all interconnected

CENTRALIZED CONTROL ROOM houses all instruments for the turbines and boilers of two units. Room features air conditioning and completely illuminated egg-crate-type ceiling

For more data on Sunbury, turn page ➤







UNIT HEAT BALANCE with two boilers feeding one turbine uses five bleed points for feedwater heating. Automatic control makes boiler-feed-pump flow proportional to turbine throttle flow. Evaporators supply makeup for losses, thawing shed, fireless locomotives, soot blowing, boiler blowdown

PIPE GALLERY *(upper left)* reflects cooperation between designer and operator. All valves are within easy reach with no need for climbing, positively identified, easily repaired

PIPING GROUPED in open vertical chases arranged for attractive appearance. Setup makes tracing, installation, repairs of piping an easier chore. See left background, top of p 75

PRINCIPAL POWER-PLANT EQUIPMENT

Sunbury Steam Electric Station, Pennsylvania Power & Light Co

TURBINE-GENERATOR and AUXILIARIES:

Turbine-generators, 2 ..... General Electric Co
75,000-kw, 3600-rpm, tandem-compound, double-flow, condensing, impulse, 1250-psig, 950-F throttle steam, 1.5-in. exhaust, 21 stages 5 bleed points. 13.8-kv hydrogen-cooled, short-circuit ratio specified 0.9, actual 1.01. 75,000 kva at 0.5 psig H_2 pressure, 100% pf, 86,250 kva at 15 psig H_2 pressure, 87.5% pf

Exciters, 3 ..... General Electric Co
250-kw 250-v flywheel-type driven by 350-hp induction motors. Amplidyne-controlled regulator

Condensers, 2 ..... Westinghouse Electric Corp
42,500-sq-ft surface, two-pass, radial-flow steel shell, divided cast-iron waterboxes, spring mounted. Condenser neck welded to turbine exhaust. 6244 Admiralty-type B tubes, 1-in. OD, No. 18 BWG, 26 ft, 2½ in. long.

Steam-jet air ejectors, 2 ..... Westinghouse Electric Corp
Two element, two-stage, with inter- and after-condensers

Hotwell pumps, 4 ..... Westinghouse Electric Corp
Vertical, centrifugal, 1100 gpm, 330-ft total head, 1160 rpm, driven by 150-hp motors

Circulating-water pumps, 4 ..... Westinghouse Electric Corp
Horizontal, centrifugal, single stage, 21,800 gpm, 28-ft total head, 345 rpm. Driven by 200-hp motor

STEAM-GENERATING EQUIPMENT:

Steam generators, 4 ..... Foster Wheeler Corp
400,000-lb-per-hr, continuous, 1350-psig, 955-F, radiant-type, single-drum. 9968-sq-ft waterwalls, 14,120-sq-ft boiler with gilled-ring extended surface, 14,500-sq-ft superheater, 14,432-sq-ft economizer, gilled-ring extended surface

Forced-draft fans, 4 ..... Sturtevant Div, Westinghouse Electric Corp
166,000 cfm at 1180 rpm, 14.5-in. static press., vane control

Forced-draft fan drive, 4 ..... General Electric Co
500 hp, 1180 rpm, 4160-v motors

Induced-draft fans, 8 ..... Sturtevant Div, Westinghouse Electric Corp
137,000 cfm, 855 rpm, 318 F, 20.5-in. static pressure

Induced-draft fan couplings, 8 ..... Electric Machinery Co
Variable speed, electronic control, magnetic type

Induced-draft fan drives, 8 ..... General Electric Co
700-hp 855-rpm 4160-v

Air heaters, 8 ..... The Air Preheater Corp
Regenerative, 62,900 sq ft surface

Air-heater drive, 8, 5-hp motors ..... Westinghouse Electric Corp

Water columns, 8 ..... Diamond Power Specialty Corp

Dust blowers, 11 per boiler ..... Vulcan Soot Blower Corp
Automatic, sequential, steam blowing, pneumatically operated

Clinker grinders, 16 ..... Westinghouse Electric Co
Three roll, hydraulic driven, under furnace-hopper bottom

Vibrating ash feeders ..... The Jeffrey Manufacturing Co
Magnetic operation, under clinker grinders

Pulverizers, 8 ..... Foster Wheeler Corp
Double classifier ball-and-tube mill, 27,000 lb per hr

Pulverizer drives, 8 ..... Westinghouse Electric Corp
600-hp motor

Coal scales, 4 ..... Beaumont-Birch Co
Automatic vibrating feeder, 200 lb per dump, truck mounted for use on one steam generator

Feeders, 6 per mill ..... Foster Wheeler Corp
Table type, 2 for prepared anthracite, 2 for anthracite silt, 2 for bituminous coal

Feeder drives, 1-hp motors ..... Westinghouse Electric Corp

Exhausters, 16 ..... Foster Wheeler Corp
Paddle-wheel type, 16,700 cfm of coal-air mixture

Exhauster drives, 100-hp motors ..... Westinghouse Electric Corp

Burners, 12 per boiler ..... Foster Wheeler Corp
Anthracite, twin-cyclone type, 4500 lb per hr per burner

FEEDWATER SYSTEM:

Boiler feed pumps, 6 ..... Worthington Pump and Machinery Co
Horizontal, barrel-type, 7-stage, 855-gpm, 4350-ft total head, 3580 rpm

Boiler-feed-pump drives, 6 ..... Allis-Chalmers Manufacturing Co
1250-hp, 4156-v, 3580-rpm motors

Low-pressure heaters, 4 ..... Westinghouse Electric Corp
Two U-tube type, mounted horizontally in extension neck of main condensers, Admiralty type A tubes. 20th-stage heaters: 2070 sq ft, 456,000 lb per hr from 84 to 140 F. 18th-stage heaters: 1640 sq ft, 505,600 lb per hr from 140 to 195 F

Deaerators, 2 ..... Elliott Co
Tray type, 770,000 lb per hr, 134,000-lb storage capacity

High-pressure heaters, 4 ..... The Griscom-Russell Co
Horizontal, condensing, U-tube type, 70-30 cupro-nickel tubes. 10th-stage heaters: 2310 sq ft, 652,000 lb per hr from 270 to 340 F, shell pressure, 130.5 psig, 7th-stage heaters, 1960 sq ft, 652,000 lb per hr from 340 to 401 F, 279-psia shell pressure
Evaporators, 2 ..... The Lummus Co
Horizontal, U-tube type with bubble-tray washer, 625 sq ft heating surface, 70-30 cupro-nickel tubes, 20,000 lb per hr vapor output
Evaporator preheater, 2 ..... Elliott Co
Vertical, tray type, deaerating

COOLING-WATER SYSTEM:

Heat exchangers, 3 ..... The Lummus Co
Horizontal, straight tube, 3285 sq ft effective surface, 484 tubes, Admiralty tubes
Heat-exchanger raw-water pumps, 3 ..... Ingersoll-Rand Co
Horizontal, centrifugal, double suction, single stage, 3000 gpm and total head of 40 ft at 1200 rpm, 1500 gpm, and total head of 10 ft at 600 rpm
Raw-water pump drives, 3 ..... Westinghouse Electric Corp
50 hp, 1200/600 rpm motors
Cooling-water pumps, 3 ..... Ingersoll-Rand Co
Horizontal, centrifugal, double suction, single stage, 1250 rpm, 185-ft total head, 1800 rpm
Cooling-water pump drives, 3 ..... Westinghouse Electric Corp
75 hp, 1800-rpm motors

COAL-HANDLING SYSTEM:

Coal system ..... Hewitt-Robins Inc, Robins Conveyors Div
Semi-automatic belt conveyor system, 20 conveyors, traveling stacker bunker shuttle conveyor, automatic coal-sample crusher. Initial capacity 450 tph; ultimate, 600 tph.
Car dumper, 1 ..... Link-Belt Co
Semi-automatic rotary car dumper, 20 standard-gage 70-ton cars per hr capacity
Coal crushers, 2 ..... Pennsylvania Crusher Co
500 tph, run-of-mine coal
Coal-crusher motors, 2, 250-hp ..... Westinghouse Electric Corp
Tramp Iron Detectors, 2 ..... Eastern Industries Inc, Automatic Signal Div
Magnetic pulleys, 2 ..... Dings Magnetic Separator Co
Weightometer, 36-in. belt, 450 tph ..... Merrick Scale Mfg Co
Bunkers, 5, 4500-tons total cap ..... Bethlehem Steel Co
Fireless locomotives, 2 ..... H K Porter Co, Inc
80-ton, 600-psig charging pressure, 6 wheel standard gage
Carryall scrapers, 3, 15-cu-yd ..... R G LeTourneau, Inc
Tractors, 3 ..... Caterpillar Tractor Co

DUST AND ASH HANDLING:

Dust collectors, 8 ..... Research Corp and Western Precipitation Corp
Combination multicyclone collector and electrostatic precipitator. Guaranteed over-all efficiency of 96%, 222,000 cfm gas at 297 F.
Flue-dust carbon-reburning system, 4 ..... National Conveyors Co, Inc
Automatically controlled, continuously operating conveying system removing flue dust from multicyclone collectors and discharging to furnace bottom. 6-ton-per-hr capacity
Dust-recovery exhausters, 4 ..... Roots-Connersville Blower Corp
Creates vacuum for conveying system, discharges at 2 psig. Positive-displacement type
Positive-displacement blowers, 4 ..... Roots-Connersville Blower Corp
Supply 10-psig air under furnace bottom to reburn carbon dust
Flue-dust-handling system, 2 ..... The Allen-Sherman-Hoff Co
Semi-automatic conveyor system removing flue dust from collectors and breeching hoppers
Ash crushers, 2 ..... The Allen-Sherman-Hoff Co
Ash-handling system, 2 ..... The Allen-Sherman-Hoff Co
Hydraulic, ash hopper, 2 ash sluices, two ash pumps, 1950 gpm each, or 50 tph ash through 3500-ft of 8-in. pipe

AUTOMATIC-PRIMING SYSTEM:

Vacuum-priming tanks, 2 ..... Posey Iron Works Inc
Vacuum pumps, 2 ..... Nash Engineering Co
Centrifugal hydraulic type, single stage, 10-cfm free air, 22-in. Hg vacuum
Drip pumps, 2 ..... Nash Engineering Co
Centrifugal, single-stage, 45 gpm with 22-in. Hg vacuum on suction, 5-psig discharge
Automatic priming valves, 15 float operated ..... Nash Engineering Co

MISCELLANEOUS PUMPS:

Chemical feed pumps, 10 ..... Milton Roy Co
Horizontal, positive displacement, single cylinder, variable stroke. 4 phosphate pumps, 12.2 gph 2000-psi total head. 3 sulfite pumps, 3 gph, 100-psi total head. 3 caustic pumps, 3 gph, 100-psi total head, stroke automatically controlled by pH controller
Condensate makeup pumps, 3 ..... Ingersoll-Rand Co
Horizontal, centrifugal, double suction, single stage. Two pumps 1000 gpm, 275-ft total head, 3600 rpm. One pump 125 gpm, 275-ft total head, 3600 rpm
Heating-system-return pumps, 2 ..... Nash Engineering Co
Raw-water pumps, 3 ..... Ingersoll-Rand Co
Horizontal, centrifugal, double suction, two stage, 2 pumps, 2000 gpm, 300-ft total head, 1800 rpm. 1 pump 725 gpm, 300-ft total head, 1800 rpm
Recirculating-water pump, 1 ..... Ingersoll-Rand Co
Horizontal, centrifugal, double suction, single stage, 36,000 gpm, 27-ft total head, 266 rpm
Sump pumps, vertical, single stage ..... Yeomans Brothers Co
Turbine-room flood pumps ..... Peerless Pump Div, Food Machinery Corp
2, vertical deepwell turbine type, single stage, 3000 gpm, 70-ft total head, 1750 rpm

HEATING AND VENTILATING:

Fans, 13 ..... Sturtevant Div, Westinghouse Electric Corp
Supply fans with total capacity 468,000 cfm. 6 air changes per hr for turbine room and auxiliary bay, 4 changes per hr for boiler room
Miscellaneous fans ..... American Blower Corp
Air filters ..... Dollinger Corp
Heating coils ..... Buffalo Forge Co
Air conditioning ..... Power Engineering Corp

AIR COMPRESSORS:

Control air compressors, 3 ..... Ingersoll-Rand Co
Horizontal, reciprocating, single stage, double acting, carbon ring, 102 cfm, 100 psig, 325 rpm
Station air compressors, 2 ..... Ingersoll-Rand Co
Horizontal, reciprocating, single stage, double acting, 322 cfm, 110 psig, 275 rpm
Yard-Service-building air compressor, 1 ..... Ingersoll-Rand Co
Vertical, two stage, 16.3 cfm, 150 psig, 500 rpm
Air receivers, 4 ..... Posey Iron Works, Inc

VALVES:

High-pressure gate and globe valves ..... Lunkenheimer Co; Henry Vogt Machine Co
Medium-pressure gate and globe valves ..... Chapman Valve Mfg Co; Henry Vogt Machine Co
Low-pressure gate and globe valves ..... American Chain & Cable Co, Inc; Reading-Pratt & Cady Div; Crane Co; Walworth Co, Inc
Safety valve (Consolidated) ..... Manning, Maxwell & Moore, Inc
Reverse-current valves ..... Atwood & Morrill Co
Nonreturn valves ..... Schutte & Koerting Co
Check valves ..... American Chain & Cable Co, Inc; Reading-Pratt & Cady Div; Crane Co; Pennsylvania Pump and Compressor Co; Walworth Co, Inc
Boiler blowoff valves ..... Yarnall-Waring Co
Evaporator blowdown valves ..... Manning, Maxwell & Moore, Inc, Hancock Valve Div
Solenoid-operated valves ..... Automatic Switch Co
Regulating valves ..... Bailey Meter Co; Fisher Governor Co; Republic Flow Meters Co; R-S Products Corp; Spence Engineering Co, Inc
Pressure-reducing valves ..... Fisher Governor Co; Leslie Co; Republic Flow Meters Co

WATER-TREATMENT PLANT:

Reactivators, 2 ..... Graver Tank & Mfg Co, Inc
Vertical, cylindrical, 15-ft 6-in. ID, 16 ft high, 200 gpm
Filters, 3 ..... Graver Tank & Mfg Co, Inc
Vertical cylindrical, 11-ft 6-in. ID, 9 ft high, 200 gpm
Clearwells, 3 ..... Graver Tank & Mfg Co, Inc
Vertical, cylindrical, 11-ft 6-in. ID, 6 ft 11 in. high
Water softeners, 2 ..... Permutit Co
Zeo-Karb Na exchange material, 300,000 gal, 470-gpm max flow
Clearwell pumps, 3 ..... Ingersoll-Rand Co
Filtered-water pumps, 4 ..... Ingersoll-Rand Co
Filtered-water standpipe ..... Graver Tank & Mfg Co, Inc
Chlorination equipment, 2 ..... Wallace & Tiernan Co, Inc
One 6000-lb 24-hr chlorinator for c-w tunnels. One automatic hypochlorinator for sanitary water systems

INSTRUMENTS AND CONTROLS:

Combustion control; Temperature recorders ..... Leeds & Northrup Co
Boiler feedwater control; Flowmeters ..... Bailey Meter Co
Indicating-pressure gages ..... Manning, Maxwell & Moore Inc
Switches, pressure control ..... The Mercoid Corp
Switches, level control ..... Magnetrol, Inc
Liquid-level indicators ..... Yarnall-Waring Co
Flow indicators ..... Fischer & Porter Co; Bailey Meter Co
Liquid-level control ..... Fisher Governor Co

MISCELLANEOUS:

Rack rake, 1 ..... Newport News Shipbuilding & Drydock Co
Traveling screens, 3 ..... Chain Belt Co
Screen wash pumps, 2 ..... Worthington Pump & Machinery Corp
Water-level differential controllers ..... Taylor Instrument Co's
Thaw-shed heaters, 4 ..... Schutte & Koerting Co
Thaw-shed pumps, 2 ..... Food Machinery Corp, Peerless Pump Div
Turbine-room crane, 50-ton main, 15-ton aux ..... Whiting Corp
Elevators, 2 ..... Westinghouse Electric Corp
Breeching ..... Connery Construction Co
Expansion joints ..... U S Rubber Co
Insulation ..... Armstrong Cork Co
Piping, general ..... Grinnell Co
Recirculating system ..... M W Kellogg Co

ELECTRICAL EQUIPMENT:

Switchgear ..... General Electric Co
Load centers, 8 ..... I-T-E Circuit Breaker Co
Load cabinets, 15 ..... Pringle Electric Co
Transformers ..... Westinghouse Electric Corp; Allis-Chalmers Mfg Co
Storage batteries, 3 ..... Electric Storage Battery Co
Public-address systems, 3 ..... Gai-Tronics Corp
Main-station control switchboards ..... Leeds & Northrup Co
Switchyard control switchboards ..... Westinghouse Electric Corp
Local control panels ..... Taller & Cooper Co
Control cabinets ..... Empire Switchboard Co

Survey of property ..... Gilbert Associates, Inc
Engineering, purchasing, general contracting ..... Ebasco Services, Inc

IT'S NOT TRUE THAT—

"There can be no protection against an atom-bomb burst"

"Harbor or river underwater burst is best way to attack a city"

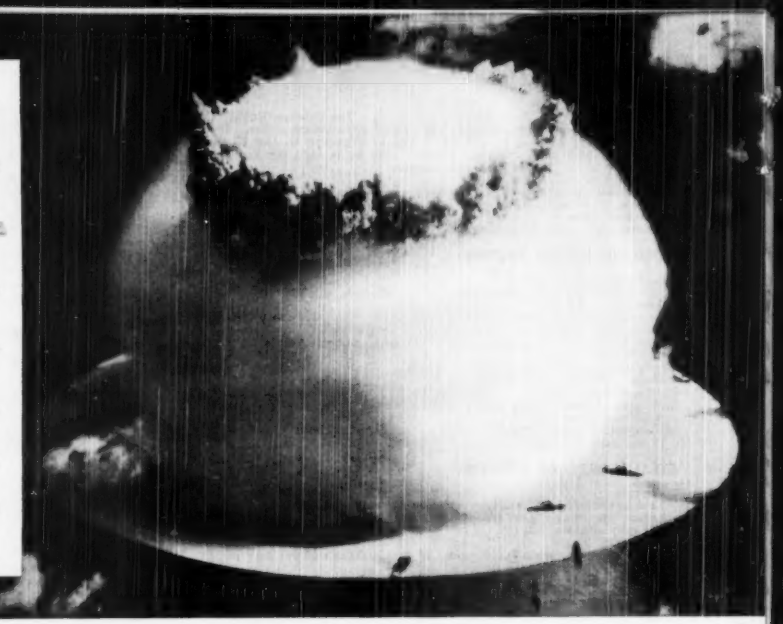
"Low air burst is more deadly than high burst"

"Most deaths are from the radioactivity"

"Residual radioactivity will keep people from moving back"

"Many people will be made sterile"

"Heat of bomb will melt steel beams like wax" etc etc etc



Killing such fictions with facts, engineers can assume leadership in plant and community to protect lives and property as they learn...

How to Size Up the Atom Bomb

By **PHILIP W SWAIN,** *Editor of POWER*

► As closely as is possible for one who never tried to pierce the veil of "security," I have tried to understand the atom bomb. In this, an engineering background has protected me from some of the nonsensical notions that were spread in the public press, even as late as the Bikini test—foolish talk about atom bombs starting earthquakes, piling up great tidal waves, maybe even destroying the whole world. When none of these things happened, some folks equally misled, viewed the A-bomb as a dud.

To people who don't think in numbers, and most people don't, the atom bomb blows hot and cold, according to who's telling the story. It becomes a mass of contradictions.

Bomb Confusion. At Hiroshima a single atom bomb, the first employed in the war, killed 70,000 people and injured a like number. Those of us who witnessed the Bikini tests saw that this was truly a weapon of unprecedented power. Particularly we were all awestruck by the underwater burst that lifted a million tons of water into a shell 8000 feet high, 2000 feet across and 300 feet thick.

Some observers seemed to confuse all this with an infinite force. But a few of us with a scientific or engineering background did our best to restore a sense of balance. We saw that this immensely powerful weapon was puny indeed compared with such natural phenomena as earthquakes and hurricanes. My own Bikini report in the McGraw-Hill publications noted that the tropical sun delivered every hour to the surface of Bikini Lagoon energy equivalent to several atomic bombs. Others have shown that the energy of an atom bomb is no greater than that released by a gentle (¼-inch) rainstorm over the area of Washington, D.C.

Such comparison was easy after the official announcement that the Hiroshima-Nagasaki-Bikini bomb equals 20,000 tons of TNT, or an energy release of 25 million kwhr, corresponding to the splitting of 1 kilogram (or 2.2 lb) of uranium 235 or plutonium atoms.

But most of us engineers, along with the reporters for the nontechnical press, were somewhat confused about radioactivity, although we have always questioned the weird picture of atom-bomb radioactivity as portrayed in the romantic school of atom-bomb literature. Today we know that these suspicions were well founded. True, the radioactivity remains as a horrible menace, but not as bad in all respects as we have been told.

The Facts Are Out. For a long time it has been clear that the atom-bomb education of the average American has been padded with too many lurid adjectives and not enough arithmetic and geometry. But now, at last, the arithmetic and geometry of the A-bomb burst are on the record, where any man with the necessary scientific education can read it.

I hold in my hand a copy of this remarkably revealing new book, *The Effects of Atomic Weapons,* prepared

for and in cooperation with the U.S. Department of Defense and the U.S. Atomic Energy Commission under the direction of the Los Alamos Scientific Laboratory. This heavily illustrated, 456-page volume became public property for anybody to quote or abstract after the 12th of August. For the general reader it has already been effectively summarized at great length by William Laurence in *The New York Times.*

Undoubtedly it will continue to be the source of various useful interpretations addressed to various segments of the American people. Here is a vast new revelation of A-bomb facts and figures. Except for the bomb design itself (still a total secret) no attempt to hold back is evident.

Many engineers will want to get this book, as will many civic leaders who sense a responsibility to try to understand the A-bomb threat.

Yet a warning is in order. This book will disappoint some of these readers because much of it speaks a difficult mathematical language. Even engineers will find some parts rather heavy going. Other parts will be clear to all who read. The fact remains that here is a treasure house of important facts never before made public. All you have to do now is "come and get it."

Why This Series? It is my plan, in this series of articles (two pages here—six in November, and seven in January) to dig out of this book facts every power engineer should know, and work them into a form that will be most useful to the engineer readers of this magazine—meaning soundly technical in a practical sense, but not highly theoretical. I shall try to talk about the bomb as POWER authors habitually deal with the physical facts of steam turbines, gas engines and motors.

Some will ask why we do it, since the atom bomb is certainly not a branch of power engineering. Here's my answer to that reasonable question:

Many American industrial cities must now face atom bombing as a real possibility. Studies and precautions tied to this possibility will eventually touch millions of people through the efforts of national, state, local and plant agencies. Even at the leadership level, thousands will be involved in the various phases of atomic protection.

Experts in medicine, nursing, transportation, police action, fire protection, etc, will play their essential parts, but some few must go beyond all this, must know *why*—must understand bomb effects in terms of energy, distance, pressure, temperature, velocities, area, etc. Only two groups have the capacity to size up the bomb in these terms—the physicists, of whom there are few, and the engineers, of whom there are many.

Job for Engineers. Along with his fellow citizens, the engineer has always carried his share of normal community activities. In doing this he was no better and no worse than the next man. Now he faces a job he alone can do. *In most plants and in many communities the engineer is the only man who can know why a bomb does what it does, or just why special-protection steps are (or are not) worthwhile.*

We sincerely hope that many readers of POWER will see in this situation a unique opportunity for personal leadership in plant and community. This series of three articles is designed to help them seize this opportunity to serve by translating for them the mathematical physics of *The Effects of Atomic Weapons* into their everyday technical language as engineers.

What's Coming. Next month's six-page article will get down to brass tacks in systematic manner, will explain the blast wave, the flash, radioactivity and other effects of an atom bomb considered strictly from the physical angle. The article will be full of actual numerical values.

The third article, seven pages in January, will interpret all this in terms of structure and people, and what to do to reduce damage and casualties.

Why It Isn't True. Many a highly intelligent engineer reader of this article will be chagrined to learn that he, too, has been the victim of some of the false notions listed in the heading. Why these are false will become clear in future articles, but some of you may be impatient for comments on atom bomb radioactivity.

Sinister mystery of radioactivity has led to its overrating. To kill 10,000 people by 2 or 3 seconds exposure to gamma rays, as at Hiroshima, is a terrible thing. But let's not forget that 85% of the total A-bomb deaths in Japan were totally unrelated to radioactivity.

Also, let's stop worrying about the dangers of residual activity on the ground—not a single recorded casualty from this cause in either of the Japanese cities. It is not a hazard except for a low or underwater burst.

Our reference book also shows that fears of permanent sterility are groundless. Those who got that heavy a dose of radiation would die anyway.

If you have seen pictures of twisted tangles of structural steel, don't imagine that the heat of the bomb melted the steel or even made it red hot. The intense thermal radiation from the bomb, the terrific "flash," affects the surface only. Subsequent common fires, of course, can distort steelwork in ways that are well known to all of us.

It's Done With Circles. In the next article I hope to make it amply clear that nobody can ever understand atomic bombs until he understands circles. You may see a hint of this in the head photograph of the underwater burst at Bikini. Note the amazingly perfect circular formations on water and in air.

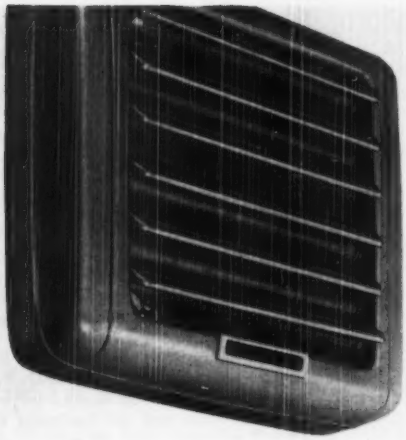
ANNOUNCEMENT

In November POWER look for a six-page factual description of atom-bomb physical effects—temperatures, pressures, velocities, radiant heat, radioactivity, in the engineer's language of arithmetic and geometry.

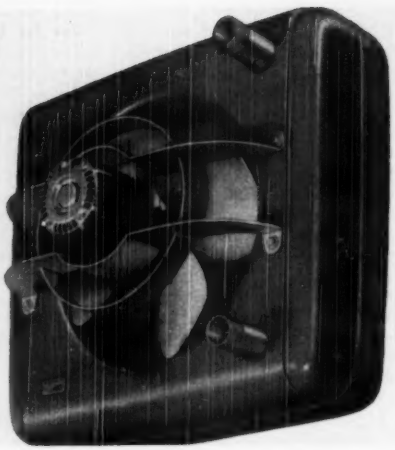
January 1951 will wind up the series with seven pages showing how the bomb burst acts on people and structures and what to do about it. Source book for this series is the new 456-page volume, *The Effects of Atomic Weapons*, prepared in cooperation with the U. S. Department of Defense and the Atomic Energy Commission.

Although somewhat heavily mathematical in spots, and not easy reading, this book is an invaluable source of basic facts for engineers concerned with atom bomb protection in plant or community.

The cloth-bound edition ($3.00) is published by the McGraw-Hill Book Co. The inexpensive paper-bound edition may be obtained from the Government Printing Office, Washington, D. C. for $1.25.



1 Horizontal-discharge units, steam or hot-water heated, come in a variety of sizes, 20,000 to 200,000 Btu per hr



2 Propeller fan on horizontal heater develops low outlet velocities, requires mounting as near floor as possible

Unit heaters have proved a flexible, practical heating tool for industrial plants. They come in a number of models, recognize and conform to warm-air heating principles. Here are tips for . . .

Getting the Most Out of Unit Heaters . . . .

By J H CARPENTER, *Manager, Engineering Training, Carrier Corp*

► BACK IN 1922, the first scientifically designed unit heater went into operation. By 1931, national sales volume ran a little over $2,500,000. Five years later it had doubled. By the beginning of 1948, dollar volume of unit-heater sales was nearly ten times the 1931 figure, $24,000,000. What's behind such a terrific growth?

Unit heaters have worked out well in a variety of applications. They recognize and conform to the principal properties of warm air, listed on facing page (How Warm Air Behaves). In addition, they possess a number of features that give them decided advantages in certain types of heating installations.

Chief among these advantages are:

1. *High heat-transfer rate:* A square foot of heating surface with gravity circulation, 2-lb steam pressure and 60-F surrounding air releases about 240 Btu per hr. Each square foot of unit-heater surface liberates seven to eight times as much heat because of increased air velocity over the heating element. This characteristic results in large capacity with small weight and space requirements.

2. *Low final temperature:* Average normal outlet temperature for unit heaters is 125 F, with 60-F entering air and 2-psi steam. There are circumstances when higher outlet temperatures are permissible. But, this feature bears an important relationship to the first principle on behavior of heated air.

3. *Air discharge* of unit heaters is at or near the horizontal plane, which is important in relation to principle 3, 4 and 6, facing page.

4. *Discharge velocity* of unit heaters ranges from 500 to 2500 fpm, induces or entrains considerable quantities of room air into the discharge-air stream. Amount of room air thus entrained varies from one to three times the unit air capacity and is dependent largely on the discharge velocity. Room air quickly reduces the temperature of the unit air stream. This is highly desirable because better distribution is possible and the tendency of the supply air to stratify is reduced.

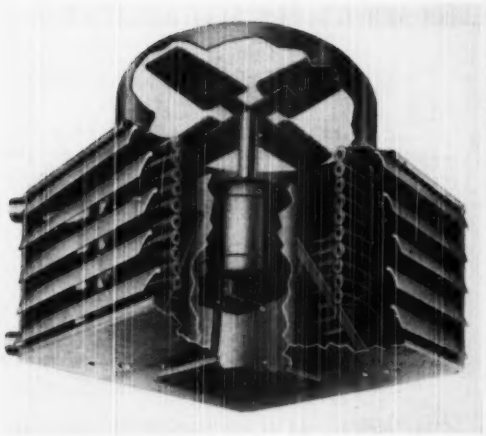
Low supply-air temperature always results in a reduction of the building heat loss because temperature differences caused by stratification are less, and over-all temperature difference to the outside wall is smaller.

Types of Unit Heaters. In general, unit heaters may be classified by the three following methods:

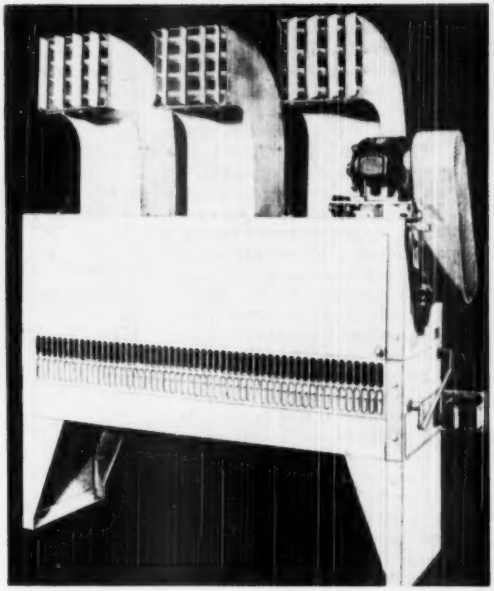
1. *Type of heating element:* (a) Steam or hot water (b) electric (c) direct fired, which may be gas, oil or coal fired.

2. *Type of fan:* There are two types of fans: (a) propeller type, which may be supplied for either horizontal or vertical operation and (b) centrifugal type, which may be arranged for horizontal or vertical discharge.

3. *Arrangement of elements:* (a) draw-through type in which the fan



3 Down-blow heaters from 50,000 to 500,000 Btu per hr work well in large structures, cover areas up to 100-ft radius



4 Centrifugal fans are used on large units with capacities ranging from 150,000 to more than 1,000,000 Btu per hr

REMEMBER

How Warm Air Behaves

1. Warm air rises vertically unless controlled
2. Different - temperature air streams stratify
3. Air moves horizontally with least energy
4. Extra energy is needed to blow warm air down; cold air up
5. Heat must be circulated to heat any zone efficiently
6. Blasts of hot air destroy comfort heating

UNIT HEATER PERFORMANCE: MAXIMUM THROW

Outlet velocity, fpm	Cu ft per min	Approximate throw feet, vane setting		
		Straight	22½ deg	45 deg
500	1000	40	30	20
	500	30	22	15
	750	50	38	25
750	1500	65	49	33
	1000	65	49	33
1000	2000	90	67	45
	1500	95	71	47
1500	3000	135	101	63
	2000	125	94	63
2000	4000	175	131	87
	2500	150	102	75
2500	5000	215	161	107

draws air through the heater element, or (b) blow-through type in which the fan blows air through the element.

Unit heaters are available in a variety of combinations of the above types. For example, a unit suitable for steam or hot water is available with either a propeller- or centrifugal-type fan, and in either the blow-through or draw-through arrangement.

Propeller-Type Fan—*Horizontal Discharge.* This type of unit, with steam or hot-water element, is available in a variety of sizes ranging approximately from 20,000 to 200,000 Btu per hr at standard rating conditions of 2-psi steam supply and 60-F entering air, Fig. 1, 2.

The propeller fan used on this type unit develops relatively low outlet velocities. As a result these unit heaters usually mount as near the floor line as possible consistent with the application. The optimum location for the center line of discharge is 9 ft above the floor.

Directional-discharge louvers are used to direct the heated air downward.

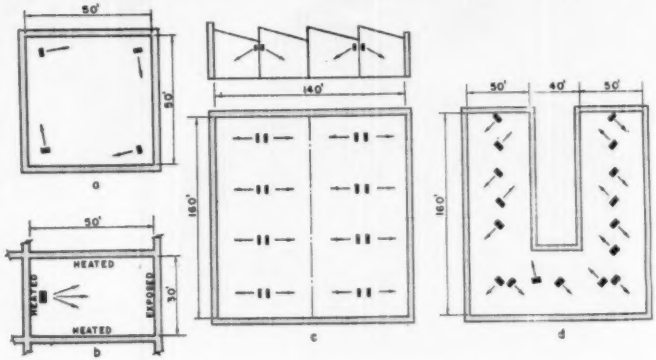
Sizes available make single units adaptable to spaces ranging in size from about 8x10 ft to 50x60 ft. Thus they are well suited to locker and toilet rooms, garages, stores, and other small areas with low headroom, Fig. 5.

Down-Blow Type. Fig. 3 illustrates a vertical-shaft propeller-type unit adaptable to large structures. Such units are available in a number of sizes ranging from about 50,000 to 500,000 Btu per hr at the standard rating point of 2-psig steam, 60-F entering air. The down-blow type effectively distributes heat from a higher level than the horizontal-type unit. In addition, the multiple-discharge louvers (on each of the four sides of the unit) permit a variety of discharge patterns. If it is desirable to project heat into an aisle or heat on an outside wall, one or more outlets may be closed. These units may be as high as 40 feet above the floor and will distribute heat up to 100-ft radius.

Several possible unit arrangements are shown in Fig. 6. It is often practicable to use one unit of this type to replace two or more horizontal- or projection-type units, with substantial savings in over-all installation costs.

Because of its flexibility, the down-blow type of heater is being more and more widely used, particularly for large manufacturing buildings, hangars, and similar structures.

EACH DESIGN HAS ITS OWN BEST MOUNTING



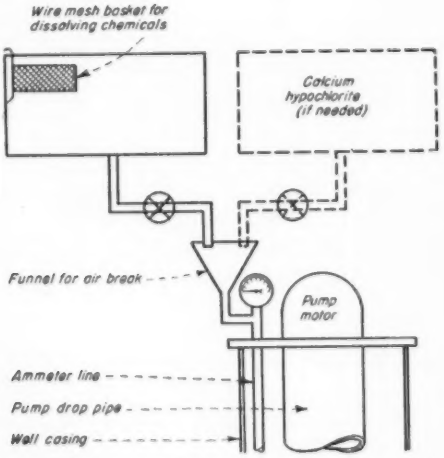
5 Horizontal heaters: (a) four walls exposed, no roof load; (b) one exposed wall, roof load or not; (c) saw-tooth building; (d) large glass area, roof load or not

Centrifugal-Fan Units. Centrifugal-type fan units are available for large space heating and special applications. These units usually employ two or more centrifugal fans mounted on a common shaft. Generally they are belt driven. They come in capacities ranging from about 150,000 to more than 1,000,000 Btu per hr at standard rating conditions.

In addition to floor-mounted units, there are also designs for horizontal or vertical suspension from the ceiling, truss work or walls.

Essential components of a centrifugal-fan-type unit show in Fig. 4. Room air is drawn into the heating coil from the floor level. This action takes the support from under the warmer-air strata, so to speak, permitting warmer-air strata to replace the cooler air, thus maintaining warmer floors.

The high-velocity discharge induces



Simple equipment is all you need to add Calgon to your deep-well. The charge runs about 16 lb per 1000 gal of water in the well. Where there is bacteria, put in some hypochlorite

Hits On Way to Give

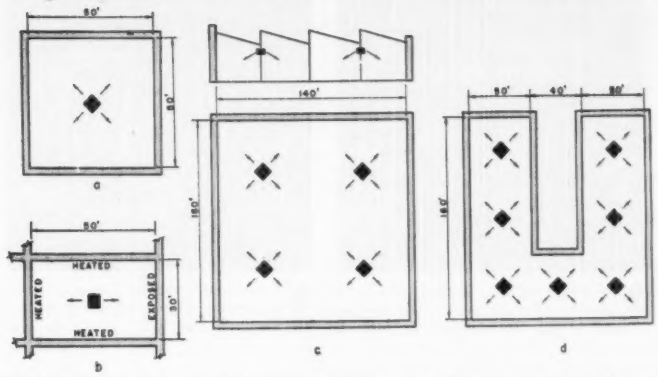
► THE MANAGER of the utilities department of a large refinery searching for new well-water sources realized that his company had abandoned 25 wells over an 18-year period. If some of them could be brought back, the job of supplying well water would be much easier.

One of the chief shutdown causes had been cleaning problems. Many of the wells had porous concrete casings, which couldn't be acid cleaned. Still others were choked up with clay and silt, and acid-cleaning wouldn't touch this.

In looking around for an effective cleaning agent this refinery hit upon Calgon. It had three properties that might help it do the job. It could: (1) stabilize a condition of supersaturation as far as the various metal oxides and salts went (2) disperse clays, metallic oxides, similar materials (3) chemically "tie up" metallic irons in the form of soluble complexes.

How did it work? The manager reported it worked fine. So they tried it on other wells, both porous concrete and gravel-packed casings. Results were good. They have set up a standard procedure as follows, and periodically clean all

PROPER LOCATION MEANS TOP HEATER PERFORMANCE



6 Vertical units: (a) four walls exposed, no roof load; (b) one exposed wall, roof load or not; (c) saw tooth building; (d) large glass area, roof load or not

large quantities of room air into the unit air stream, increasing the total amount of air in motion, quickly reducing temperature of the unit discharge stream. Result is less stratification and a reduction of building heat losses.

Three factors affect the degree of stratification that occurs in a heated space. These are: (1) temperature of discharge air (2) velocity of discharge air (3) location of unit.

Stratification is minimized, at a given steam pressure, by use of floor mounted units. Final discharge temperature is a function of steam pressure and heating surface. But the tendency of high-temperature air to rise is kept to a minimum by high outlet velocities and floor mounting of the unit.

There are occasions when floor-mounted units are not feasible and high, suspended units are more advantageous. It should be recognized, however, that some penalty results because of increased stratification. Wherever possible, it is desirable to avoid combinations of mounting height, steam pressure and velocity that promote stratification and increase fuel consumption.

When centrifugal-fan-type units are suspended their effectiveness can be greatly improved by the installation of a return-air duct originating near the floor line. This arrangement helps remove cool air from the floor and reduce stratification within the structure.

Centrifugal-type units are also effective in (1) preventing excessive infiltration of air through large open doors, and (2) quickly restoring the adjacent area to a normal temperature after the doors are closed.

The centrifugal-type fan is capable of developing higher discharge velocities than the propeller-type fan, permitting greater floor coverage. A single unit can adequately distribute air in spaces 100 ft wide by 200 ft long. Since these fans are also capable of operating against external static pressure, they should be used when ductwork or filtering is required on either discharge or inlet side of unit.

The approximate throw in feet that can be anticipated from a unit heater is shown in the table. These data are applicable to propeller-, down-blow- or centrifugal-fan-type units.

Old Wells New Life

wells to hold their capacity. Hookup shows to left, on the facing page.

Cleaning Procedure. 1. Pull the well out of service for 24 to 48 hours. Since the cleaning agent is non-corrosive to either metal or concrete a well that has lost capacity because of plugging or clogging can be cleaned without removing equipment.

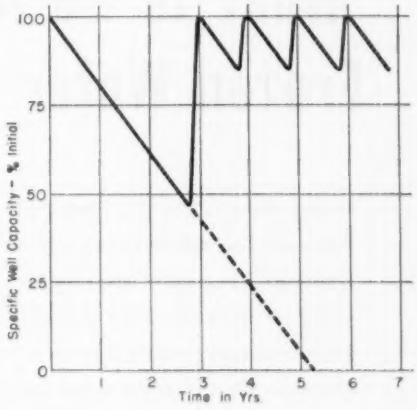
2. The charge, about 16 lb of Calgon for 1000 gal of water in the well, goes into the well casing, in solution or solid form as desired. If bacterial growth is suspected, add enough calcium or sodium hypochlorite to disinfect the well.

3. Rapidly start and stop the well pump so water just reaches the surface before falling back. This sets up the needed agitation. Surge the well about 12 times every four hours for 24 to 48 hr.

4. Flush the well to waste until the water clears up.

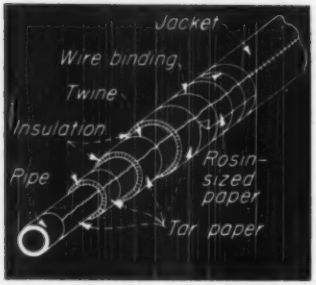
In many instances where this procedure has been tried it has restored original well capacity, increased pressures, reduced drawdown. See chart, right.

CALGON, INC, PITTSBURGH, PA.

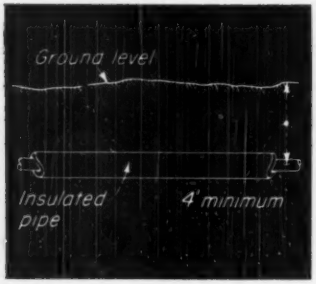


Cleaning method used on 24 wells with previous life of 5 yr restored them to original capacity. With periodic cleaning, it gives prolonged service life, as is shown in the graph

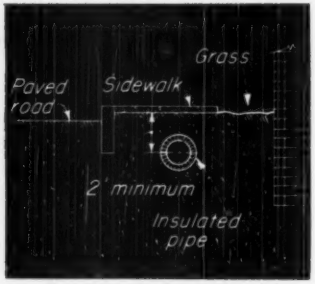
SKETCHES SUMMARIZE EASY AND PRACTICAL MEANS TO PREVENT WATER-PIPE FREEZES



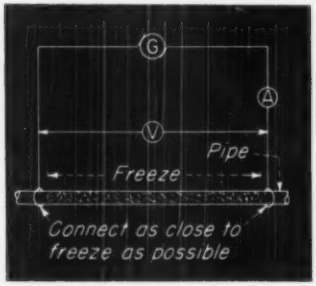
1 To protect pipes from freezing apply a suitable insulation or a sectional covering. Sketch shows use of hair felt



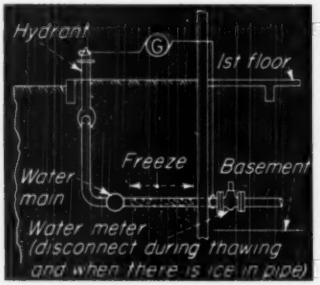
2 Always bury pipe below frost line to prevent freezing. About 4 ft beneath ground is safe for many U.S. localities



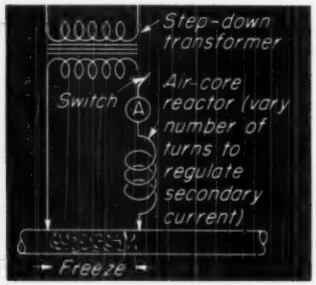
3 Paved roads, sidewalks and grass act as insulators and protect pipe from freezing. Two-ft bury is usually good



4 Isolate freeze and connect wires close to each end. Use ammeter, voltmeter to check current conditions while thawing



5 Hooking wire to fire hydrant makes thawing easy with freeze as shown. Hydrant wire must be guarded carefully



6 Stepdown transformer fitted with a homemade air-core reactor does good thawing job. Reactor regulates current

What to Do About Frozen Water Pipes

Water pipes shouldn't freeze but they sometimes do. This article shows you how to prevent freezeup by proper installation. It also tells you how to thaw pipes that do freeze—either from improper installation or a bad bite from Old Man Winter. Now is the time to get ready

► YOU CAN FIGHT pipe freezeups in two ways: (1) by proper installation and (2) with electricity after a freeze has occurred. Since installation is important as a preventive we'll look it over first.

Installation. All above- and below-ground water pipes, hot or cold, should be insulated. For good results use frostproof sectional covering or three 1-in.-thick layers of suitable insulation. Wrap heavy tar paper around pipe and between each layer of insulation, Fig. 1, when using hair felt. Secure each layer with strong jute twine and cover exterior with layer of tar paper, held in place with No. 16 copper-wire loops spaced 4 in. apart. If a canvas jacket is needed, use rosin-sized paper between it and tar paper. Prefabricated insulated piping is good for all jobs, too.

When burying water pipes keep them at least 4 ft below ground level. If you can't go that deep make it 2 ft, but never less. Keep pipes below frost line.

Pipes in wet clay soils freeze fastest; bury them as deep as possible, Fig. 2. Sidewalks, lawns and macadam roads offer some protection against frost, so

THAWING CURRENTS, TIME AND CABLE SIZE

Pipe dia, in.	Amp	Approx thawing time, min	Cable size	Cable resistance, ohms/1000 ft
¼	75	15	6	0.0395
½	125	20	2	0.0156
¾	200	20	1/0	0.0098
1	250	30	2/0	0.0078
1½	300	30	3/0	0.0062
2	350	40	4/0	0.0049
4	600	75	400,000	0.0027
6	800	120	600,000	0.0018

you need not bury pipes so deep below them, Fig. 3.

Where water may lie stationary in a pipe for long periods insulation can't always prevent freezing. For these cases run a steam or hot-water line close to the cold-water pipe and enclose both in same insulation. You can use electric resistance heaters, too.

Water Velocity. Water traveling at 4.25 ft per sec does not freeze in a bare pipe at 32 F. If temperature falls below 32 F, water freezes no matter what the velocity if line is long and diameter small. So if there's a chance of freezing, pick a pipe that gives a velocity of at least 4.25 fps and insulate it. Pumping costs may be a little higher but you'll avoid freeze damage and expense.

Remember, a pipe bursts when it freezes because ice occupies more space than same amount of water. And even though you have copper tubing, which may not burst when frozen, it still needs protection. Don't try to save pennies today by cutting down on insulation. Tomorrow you may have to spend dollars for a new run of pipe or tubing.

Thawing. Suppose, despite all your efforts, water pipes do freeze? What then? Often you can save the pipe if you act fast. This means you must keep an eye on water flow rate and have thawing equipment ready for use. Just as soon as there's a marked decrease in water flow during winter and you can't find cause, get ready to thaw.

Thawing with electricity is easy, cheap and fast. Both ac and dc are suitable. All you need is a stepdown transformer or arc-welding machine. Output of latter should be at least 300 amp at an open-circuit voltage of 60. Usual welding generator is good for thawing and is easy to obtain. Transformers with proper kva rating are hard to find—so stick to a welding generator unless a transformer is handy. You'll need hefty cable or conductor bars no matter what you use for current supply.

When you thaw with electricity, current flows along the pipe surface, generating heat. Ice inside the pipe melts, allowing more water to enter pipe and speed up thawing. With plant end of pipe open you should be able to thaw average freeze in 20 to 40 min.

If freeze is indoors, locate by tapping pipe with a piece of metal. Where pipe sounds solid you can be fairly certain you have ice. If entire pipe is underground, dig holes at both ends for wire connections. Disconnect unfrozen pipe.

Briefly, the idea is to isolate the frozen section of pipe and connect one wire near each end of freeze, Fig. 4. One connection to the pipe and another to a nearby fire hydrant is good if freeze is between, Fig. 5.

Applying Current. The table gives suitable cable sizes for various pipes. No matter how you connect cable, be sure you have a complete circuit between power source, pipe and freeze. If there are water meters or any instruments in the pipe it's a good idea to put jumper cables around them. Cable should be at least as big as in table.

If you want to figure voltage drop in thawing circuit, allow 5 volts line loss, 1 volt for each 7 ft of pipe, and count a screwed fitting as 1 ft of pipe.

Remove all ground connections from pipe before applying current. This means lighting, telephone and radio grounds. If you don't remove ground connections, juice may run into these devices and cause more headaches. Open all nearby faucets served by frozen pipe. This helps relieve pressure as ice thaws. If there's any chance of ice entering the water meter, disconnect it. Make sure gas meter and pipe do not contact water pipe.

Start current flow at low value, 10 to 20 amp, and build up slowly to that in table. Check pipe temperature every five minutes; if pipe is too hot to touch, shut off current and allow it to cool. A quick thaw is needed to prevent further freezing, but large currents should not be used as they may cause trouble.

Be especially careful with lead-pipe temperatures or you may have only a puddle of metal left. Currents of 75 to 125 amp are usually safe for lead pipe. If lead joints give trouble, thaw pipe in sections, omitting joint from circuit.

As the ice melts you'll get a sputter of water from various faucets. Don't start to taper current supply until water flow from each faucet is normal. Then stop current flow and allow water to run from several faucets for about an hour. This will rid piping of any small pieces of ice that may lodge around fittings.

A frozen pipe may break at any time during freezeups and thawing. So it's a good idea to station a man near the main shutoff valve at all times during freezeups. Then if the pipe breaks, he can spin the valve shut and prevent serious flood damage.

Operating Hints. If you decide to use stepdown transformers for thawing, you may run into trouble when trying to regulate secondary current. Best way is to use a homemade air-core reactor, Fig. 6. Do this by turning a few loops in the secondary cable connecting the transformer and water pipe. With this trick, you can vary the current flow by number of loops you make in reactor.

With a portable welding set the question of current control becomes one of adjusting generator field strength. Remember, welding generators are hooked up differentially. That means when load current flows, the series and shunt field are in opposition. Generator open-circuit voltage drops quickly as you add load.

If ammeter doesn't show current is flowing during thawing, you have a bad joint in a pipe, a broken pipe, a poor connection, or some part of system grounded. Best way to restore current flow when pipe is broken is by putting a jumper around defective joint or pipe. If this doesn't help, check wire connections to pipe. They must be clean and tight.

Once you've thawed a pipe inspect it carefully to see that threads, flanges, fittings and valves have not been damaged. Pipe stretches when water in it is frozen. Although it may not burst there is still danger of damage to fittings and other parts of the system. Cracks in cast parts are quite common.

Yes, electricity can do a good thawing job if you disconnect unfrozen pipe.

Better than thawing, however, is an insulated pipe installed below the frost line. Just remember that a 1-in. insulated pipe takes about three times as long to freeze as the same size pipe without insulation, when there is no flow in pipes. Do this and you'll seldom have to thaw frozen water pipes.

Five Advantages of Demineralized Makeup

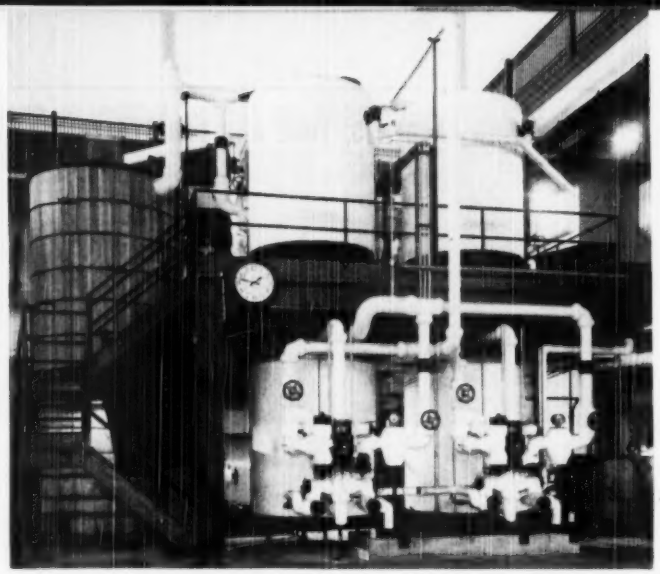
1 Assured Ample Supply

2 Improved Quality

3 Lower Operating Costs

4 Lower Labor Costs

5 Lower Maintenance Costs



Demineralizer plant on two levels consists of a duplicate set of cation, anion and silica-removing elements with one aerating tower for carbon-dioxide removal

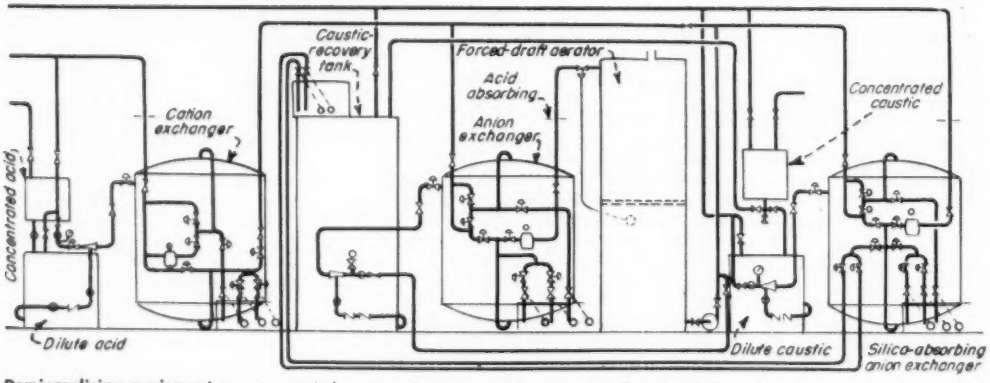
Demineralizer Produces Plant Savings

Here are up-to-date data on cost, operating advantages, expected returns from the first complete demineralizing plant to treat boiler makeup water in a central generating station

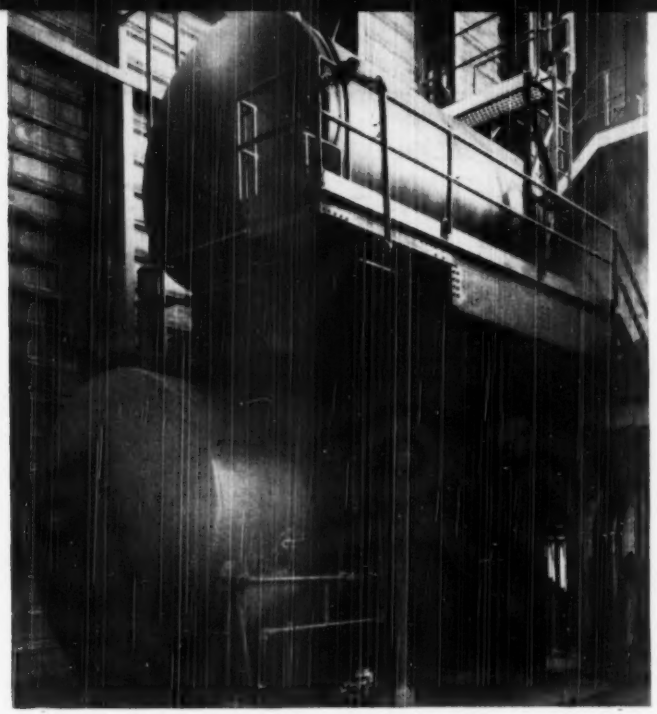
By I L WADE, *Manager, Electric Production*
Public Service Co of Northern Illinois

► WAUKEGAN GENERATING STATION of Public Service Co of Northern Illinois recently put into operation (April 1950) the first complete demineralizing plant to treat boiler makeup water in a central station. It replaces evaporators already in operation on the three most recently installed boiler turbine units. In addition, it is expected to eliminate any need for evaporators on 1800-psi unit No. 6, scheduled for late 1951 operation. This demineralizing plant went in on the basis of thorough preliminary engineering studies.

The five principal advantages that these studies indicated are as follows:



Demineralizing equipment operates entirely automatic except for pumpage of concentrated sulfuric acid and caustic soda from storage. Functional dial of each unit control is turned to "on," demineralization continues for set water volume



Concentrated sulfuric acid and 50% caustic-soda solution are stored in 10,000-gal tanks along a track siding so liquid chemicals can be delivered by side car

(1) *Adequate makeup supply at all times.* Because evaporator output varies with turbine load, evaporators do not maintain rated output at low loads. Demineralizing plants, on the other hand, can always operate at rated capacity.

(2) *Reduced operating costs.* Gains in turbine-cycle efficiency are so great they more than compensate for the considerable chemical costs of a demineralizing treatment.

(3) *Improved makeup quality.* Product is better and more uniform as well as practically free from corrosive CO_2 produced in evaporators.

(4) *Reduced maintenance costs.* Improvement in having less of the noncondensable gases cuts down the corrosion problem throughout the feed-water system, boilers and turbines. While expenses due to corrosion are conceded hard to evaluate, observation of corrosive action indicates some of it is probably due to CO_2 from evaporators.

(5) *Reduced labor costs.* New demineralizing plant is nearly automatic so labor costs are expected to be less.

Original Makeup System. At present, Waukegan station has a capacity of 290,000 kw, made up of five turbine-generator units of 25,000, 35,000, 50,000, 65,000 and 115,000 kw capacities. First two went on the line in 1923 and 1925. They operate at 350-psi throttle pressure. Last three were installed in the period of 1927-1931 and operate at 650-psi throttle pressure.

Makeup for the six boilers serving the first two units comes from Lake Michigan but is sodium-zeolite treated before entering the boiler cycle. For the ten boilers supplying the last three units, five evaporators provided makeup from filtered Lake Michigan water. Extracted steam from the last three turbines went to these evaporators, and feedwater-type evaporator condensers condensed the vapors.

These five evaporators were arranged as in Table I., p 90. No. 4 and 5 unit evaporators were connected for single- or double-effect operation. But they were run single effect to produce a better-quality distillate and at higher capacities.

The evaporators of 50,000-kw unit 3 and 115,000-kw unit 5 produced a good-quality distilled water when worked at a constant rating. Total solids ran from 2 to 6 ppm. (Evaporators of 65,000-kw unit 4 did not produce as good a quality distillate because of low-pressure operation. Total dissolved solids ranged from 4 to 10 ppm.

All these evaporators were susceptible to load changes and experienced excessive carryover during these periods. Considerable test work had been required to give as good distillate quality as above, and close attention to operating conditions had to be maintained. Feedwater to these evaporators was not treated and vapor from them was highly contaminated with oxygen and carbon dioxide, an extremely corrosive product.

Under normal station-load conditions these five evaporators did supply most of the makeup requirements. But, service conditions of units 3, 4 and 5 from 1939 to 1949, and of the evaporators and evaporator condensers aggravated the distilled-makeup-water shortage. Loss of any of these turbine-generators, or evaporator condensers, resulted in loss of evaporator capacity of that unit. At these times it was necessary to use zeolite-softened water to make up the loss in evaporator capacity.

Use of zeolite-softened water and operation of No. 4 unit evaporators resulted in large sludge accumulations in the boilers. That meant considerable outage for internal cleaning. It was difficult to schedule boiler outages for acid cleaning because of the high loads carried during the war and postwar periods.

Preliminary Studies. Engineering studies and chemical analyses were made to determine the best way to obtain an adequate supply of high- and constant-quality makeup. Here's what was considered: (1) Installation of additional evaporator capacity. (2) pretreatment of evaporator feedwater (3) complete demineralization, including silica removal and retirement of present evaporators.

Installation of evaporators in the turbine cycle of the 25,000- and 35,000-kw units did not seem practicable because of the turbines' ages and proposed future use on lower capacity factors. Also, amount of distillate would be relatively small. To increase capacity by design changes on units 3, 4 and 5 did not seem to offer much advantage. Moreover, experience indicated that good quality was not produced unless distillate quantity was reduced to about one-half rated capacity. The high cost of making these changes was also a factor in eliminating this method.

Pretreatment of evaporator feedwater is now a common practice and may be accomplished by either the cold or the hot lime-soda process, or by partial demineralization. The cold lime-soda process was more feasible than the hot process because of evaporator operating conditions. These procedures did not seem so attractive as the partial demineralization process for several reasons.

Partial demineralization was to be accomplished by installing two 60,000-lb-per-hr hydrogen-zeolite units. Water

from these units, after deaeration, would be neutralized with sodium hydroxide and then fed to the evaporators. A 30,000-lb-per-hr anion exchanger would be required to provide a source of high-quality water during evaporator outages.

Pretreatment of evaporator feedwater would eliminate most of the carbon dioxide and provide a relatively non-scaling water, which would permit higher over-all evaporator outputs than was possible with untreated feed. Corrosion would be materially reduced and the "cracking down" of evaporator tube bundles for scale removal would also be materially reduced.

Cost analysis of the partial-demineralization process indicated the investment could be justified on the basis of maintenance returns and plant reliability.

Complete Demineralization. The advent of better exchange materials, particularly those capable of removing silica, made complete demineralization feasible. A rather thorough investigation of these materials including some laboratory tests, indicated such a procedure was indeed practical.

At the time this matter was being explored, it was decided to increase plant capacity by installing a 110,000-kw turbine-generator operating at a throttle pressure of 1800 psi, and supplied by an 830,000-lb-per-hr, cyclone-fired, reheat boiler. Requirements for makeup water for such a boiler are exacting and so the water could contain only very small quantities of silica, calcium and magnesium compounds. It was decided that, if it were possible to produce demineralized water substantially CO_2 free and containing not more than 0.2 ppm of silica and 0.2 ppm of hardness (calcium and magnesium), this water would be suitable for the high-pressure boiler, and it would not be necessary to provide evaporators for this new unit. Plans were developed for such a system, with the above specifications of purity.

Examination of the several plans indicated water of such a quality could be produced. There was a rather wide variation in chemical costs and some differences in required operational procedures. Some of these procedures did not seem to lend themselves too well to power-plant operation.

Operational costs showed a considerable saving would be effected compared to present evaporator operation. This saving alone would justify the purchase of a demineralizing system. Additional savings would come from reduced maintenance and elimination of evaporators for the new unit. The proposal submitted by Infilco, Inc, of Chicago, was accepted about one year ago.

Equipment. Installation selected consists of a duplicate set of cation-, anion- and silica-removing elements with one aerating tower for the removal of carbon dioxide (photo, top of p 88).

Each set—one cation-, one anion- and one silica-absorbing unit—is rated at 120,000 lb per hr. But the two sets will normally operate in parallel so (1) flow rates are reduced (2) better than guaranteed-quality water is produced.

Plant occupies a floor space of about 30x40 ft, representing a volumetric space of 33,600 cu ft on each of two levels on the auxiliary floor of the turbine room, p 88. The 10,000-gal storage tanks for concentrated sulfuric acid and 50% caustic-soda solution, also on the auxiliary floor, (photo, p 89), lie alongside a track so liquid chemicals are delivered by tank car. Floor space for these two tanks is 16x30 ft, representing a volumetric space of 15,400 cu ft.

No new building space had to be provided for the complete installation went into already available space, so situated that it did not interfere with any other plant operations.

Demineralization Control. Completely automatic are operation of the demineralizing equipment, except pumpage of the concentrated sulfuric acid and caustic soda from the storage tanks, and dilution and mixing of these solutions for regeneration.

Functional dial of each unit control is turned to "On" position and demineralization goes on until the volume of water for which the meters have been set has passed through. Closing these contacts starts the regeneration cycle, which consists of a backwash, a regeneration and a rinse period. After this the demineralizer is placed back in service. Provisions are made for manual control of each of the various units. All valves, except a manually operated, rubber-diaphragm shutoff valve for each unit, are the rubber-diaphragm, air-actuated type.

All timers, relays and other electrical control equipment are housed in one end of an instrument panel 10 ft long by 7½ ft wide by 2 ft deep. This panel also has flow indicators and recorder, a 2-point pH and a 2-point conductivity recorder. It stands alongside the demineralizing unit on the lower level.

A float-operated valve in a 15,000-gal storage tank controls the quantity of water the demineralizer produces. This tank connects to storage tanks having total capacities of about 35,000 gal.

Shutdown of the demineralizer during any portion of its run is not expected to affect the product's quality adversely. Alkalinity of the final product may go up, perhaps about 5-10 ppm of sodium hydroxide for a 2-to-3-hr shutdown. But this is not considered detrimental, and the total quantity of sodium hydroxide leakage, per run, will be constant.

Quality of the demineralized water is determined by pH and conductivity measurements, and determination of total hardness and silica content, and methyl orange (alkalinity) and total mineral acidity determinations. Sodium leakage through the cation exchanger is detected by a flame photometer. Total hardness determinations are made by both the laurate (turbidity) and the recently developed colorimetric (disodium dihydrogen ethylenediamine tetracetate dihydrate) methods. Colorimetric checks determine silica concentrations.

I—ORIGINAL EVAPORATOR INSTALLATION

Unit No.	Turbine capacity, lb/hr	No. of evaporators	Evap capacity lb/hr full load	Pressures (full load) psi	
				Bleed steam	Vapor
3	50,000	1	22,000	120	77
4	65,000	2	25,000	35	6
5	115,000	2	70,000	170	30
Total, plant	290,000	5	97,000		

II—COST ESTIMATED PER YEAR: 50,000,000-GAL MAKEUP

Demineralizer		Evaporator	
Chemical's cost	$2000	Heat cost, fuel	$12,000
Sulfuric acid—$17/ton		Distilling—24¢/1000 gal	
Caustic soda—2.40/cwt		Cycle Btu loss, cost	$11,000
Material-replacement cost	$4000	(Makeup enters cycle higher than with demineralizer.)	
Anion exchangers—2 to 3¢/1000 gal			
Silica absorber—2 to 3¢/1000 gal			
Resin exchange—5% for 2 years			
Total costs	$6000	Total costs	$23,000

III—ANALYSES OF RAW AND TREATED WATER

Raw water, ppm (Lake Michigan)		*Demineralized, ppm*
130 (as $Ca_2 CO_3$)	Hardness	0.2
104 (as $Ca_2 CO_3$)	Alkalinity	—
32	Calcium	—
12	Magnesium	—
5	Sodium	—
25	Sulfate	—
5	Chloride	—
5	Silica	0.2
156	Total solids	1-5
—	pH	8-8.5
—	CO_2	0

Each of two cation exchangers contains 125 cu ft of sulfonated coal, supported on a 13-in. bed of graded anthracite coal. Each exchanger treats 92,000 gal of water between regenerations. Acid requirements run about 3.26 lb per 1000 gal of water treated.

Each of two anion exchangers contains 100 cu ft of exchange material supported on a 13-in. bed of graded anthracite coal. Two different exchange resins are being supplied. One of these is Chemical Process Co's A-5 resin and the other is the Resinous Products Division of Rohm and Haas Co's Amberlite IR-4B resin. Each exchanger treats 480,000-gal of water between regenerations. Caustic soda for regeneration is recovered from the silica absorbers during their regeneration period. So no additional caustic above that utilized in these silica absorbers is required. The caustic-soda solution may be re-used after recovery from the silica absorber because the reclaimed solution contains only silica and carbon dioxide. These are not absorbed in the weakly basic exchange material used in these anion exchangers. This arrangement is one reason why chemical costs are quite low. It has reduced chemical costs by 1.5 to 5.5c per 1000 gal over conventionally regenerated exchangers.

Each of two silica absorbers contains 85 cu ft of Resinous Products Division of Rohm and Haas Co's Amberlite IRA-400 resin supported on a 13-in. bed of graded anthracite coal. Each exchanger treats 750,000 gal of water between regenerations. Caustic-soda requirements are about 0.40 lb per 1000 gal.

Pretreatment to Demineralizer. It is deemed advisable to supplement the present sand and gravel filters with a flocculating agent to reduce turbidity, and suspended silica content, of the raw water being fed to the demineralizing unit. This pretreatment tends to prevent the occlusion of solid materials by the exchange materials in the demineralizing units and reduce the quantity of silica absorbed by the silica-removal unit, thus decreasing chemical costs. Pretreatment system consists of chemical-storage tanks for alum and sodium-hydroxide solutions, proportioning equipment and a coagulating tank. This tank was rebuilt from one of the old zeolite-softener tanks.

Equipment is located in available space next to a 3-filter bank of sand and gravel filters. They have been recently overhauled and new filtering media put in. It did not seem necessary to use anthracite-coal filter beds for there would be little, if any, pickup of silica by the water being filtered through these beds. Alum and caustic-soda solution tanks, proportioning pumps, controls and coagulating tank are installed in a space 10x16 ft and occupy 2000 cu ft of space.

Cost Analysis. See table II. Total chemical costs, based on sulfuric acid at $17.00 per ton and caustic soda at $2.40 cwt, are expected to be about 3.75 to 4.0c per 1000 gallons. At present, about 50,000,000 gal of makeup per year are required. This gives a chemical operating cost of $2000 per yr.

One item of more than passing interest is the anticipated life of the exchange resins and their replacement costs. The cation material, sulfonated coal, has an expected life of several million gallons per cubic foot. At the present rate of makeup requirements, this material is expected to last more than ten years. Replacement cost is expected to be about one cent per thousand gallons of water treated.

Exchange resins used in the anion exchangers will, after they have passed about one million gallons per cubic foot, have an exchange capacity of about 12,000 gr per cu ft, which is new "design" capacity. If we can assume this represents the useful life of the anion-exchange materials, then replacement costs represent a charge of 5c per 1000 gal. It is more probable that replacement of this material will represent a charge of 2 to 3c per 1000 gal because of a slower rate of depletion or because the resin will be used after it passes the 12,000 per cu ft exchange capacity.

Anticipated life of the highly basic exchange resin in the silica absorber is comparable to that of the anion exchangers. It can again be assumed that replacement costs will represent a charge of 2 to 3c per 1000 gal.

Total replacement costs of exchange materials will probably be about 6 to 8c per 1000 gal. Using the higher figure gives $4000 per yr.

There is a guarantee that resin-exchange-capacity loss will not exceed 5% per year for two years, or for the passage of 100,000,000 gal of water.

Producing Evaporator Makeup. Cost of producing distilled makeup water by evaporators, based on heat costs at current coal prices, is about 24c per 1000 gal. At the present rate of 50,000,000 gal of makeup water per year, this will cost about $12,000 per year.

Demineralized water will be taken as makeup into the condensers, whereas evaporator makeup is in effect taken higher up in the cycle. Thus a charge for this difference in economy must be made against evaporator makeup. It equals about 22c per 1000 gal, or $11,000 per year. Total estimated cost chargeable to evaporator makeup, therefore, is $23,000 per year.

Adding the $2000 chemical operating bill to the $4000 exchange material replacement charge, total costs for demineralized water per year run $6000. Compared to $23,000 evaporator estimate, a $17,000 savings is indicated for the demineralizing plant.

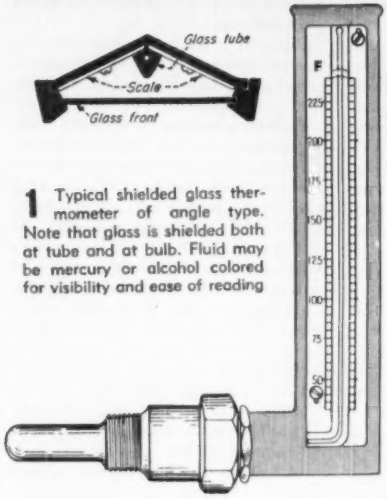
Investment Cost. Total cost of the demineralizing plant, exclusive of charges for building space, is expected to be $170,000. Without any other consideration, the $17,000 expected savings appear sufficient to carry this investment, but actually this is not the true picture.

Before the decision to go to completely demineralized water, it had been concluded that pretreatment to eliminate excessive maintenance from corrosion was necessary and economically justified. So cost of the evaporator-pretreatment plant should be subtracted from the $170,000 to get a direct comparison. Demineralizer plant has sufficient capacity for the new turbine-generator to be installed and is expected to produce a water suitable for this 1800-psi unit. So cost of evaporators and associated pretreatment equipment should also be subtracted from the demineralizing cost. It appears then that these costs will practically balance out so the $17,000 per year savings in going to demineralized water is a net figure.

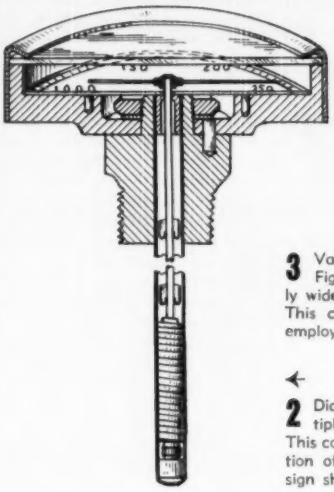
Operating Data. More than the usual amount of operational data will be kept on this installation as it is the first of its kind in a central station. A report on its operation will be issued as soon as data collected and elapsed time are sufficient so data are representative.

Engineering layouts for this job were by Sargent & Lundy. Professor F G Straub of the University of Illinois acted as consultant on the water-treating problems

THERMOMETERS TAKE A VARIETY OF FORMS, SUITABLE FOR EITHER ON-THE-SPOT USE



1 Typical shielded glass thermometer of angle type. Note that glass is shielded both at tube and at bulb. Fluid may be mercury or alcohol colored for visibility and ease of reading



2 Dial thermometer has a bimetal multiple helix as its actuating element. This converts temperature changes to motion of pointer over scale. Straight design shown has no pivots, gears or links

3 Vapor-pressure dial thermometer, like Fig. 4, has a scale with progressively wider divisions from low to high end. This contrasts with liquid types, which employ a scale with uniform graduations

Diesel Instruments and Controls: 3

By **EDGAR J KATES**
Consulting Engineer, New York, N. Y.

Tools for Cooling-System Control

► WHEN FUEL BURNS in the cylinders of a diesel or gas engine, things get pretty hot—too hot for metals to take without some relief. So cylinder liners and heads are jacketed and flowing water carries away enough heat to keep the situation under control.

It's easy to see that this heat-removal job must be done. It's not so easy to see that close control is also necessary. In fact, many designers and operators of the early days were satisfied with sketchy layouts and controls. So, defective cooling systems caused failure of engines that should have lived long and useful lives. Such troubles are rare today because we've learned the few simple rules that make for good cooling. What are they?

Good cooling depends on: (1) how much the water's temperature rises in its passage through the engine, (2) what its temperature is when it leaves, and (3) how pure the water is.

Temperature Rise. Let's look at temperature rise first. This ties directly to water flow, and both are important. There's just so much heat to remove. If we have a high flow rate, we absorb the heat in a lot of water and its temperature goes up only a little. If we cut down the flow rate, less water must remove the same amount of heat. So temperature rise is thereby greater.

What difference does temperature rise make? Well, the greater the temperature difference between entering and leaving water, the greater the difference between temperatures at bottom and top of cylinders. This means more heat distortion, greater thermal stresses. So to keep temperature rise down we boost flow rate. Then we get a dividend because rapid flow through water jackets avoids vapor pockets and local hot spots.

Leaving Temperature. If we avoid heat distortion and local hot spots, we can safely use a higher "off-engine" water temperature. This improves engine efficiency. Also, since we usually cool the water outside the engine and recirculate it, a high off-engine temperature gives a greater temperature difference to work with in the cooling equipment. This helps cut its size and cost.

Because temperature rise and rate of flow are related, and temperature is generally easier to measure than flow, we usually gage cooling effectiveness by temperature rise—that is, by measuring temperature of water entering and leaving engine. Good design limits temperature rise to 10-15 F at full load.

Water Purity. We might have high flow rate and low temperature rise, and still run into trouble from water quality. Most natural waters carry scale-forming impurities. At temperatures met in engine jackets, these precipitate and coat the surfaces. Such scale formation cuts rate of heat flow from combustion space into the water jackets. Metal temperatures thus run higher. Local overheating is likely, with cracks and failures as a possible result. The now commonly used "closed" cooling system largely avoids such problems. We'll take a closer look at it later.

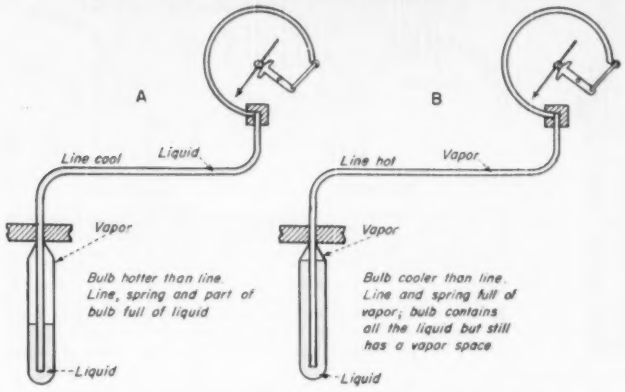
To put these rules for good cooling into effect we need controls to regulate flow, indicators to keep tabs on operation. And, of course, we must have a cooling-system hookup that fits our conditions. This article deals with the instruments and controls available for the job; the next will tell how to apply them in various cooling-system layouts.

TEMPERATURE INDICATORS

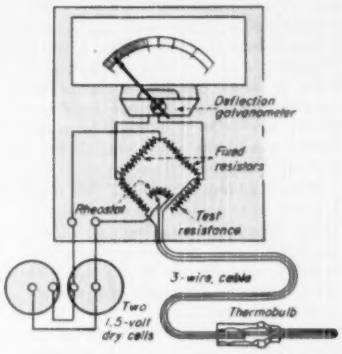
Temperature indicators commonly used on diesel and gas engines fall into two classes: (1) shielded glass thermometers, and (2) dial thermometers.

Shielded glass thermometers are available in many sizes and shapes. Stems may be straight, angle (Fig. 1) or oblique. Note that glass is shielded both at tube and at bulb. Fluid may

..OR INDICATION AT SOME REMOTE POINT—ON A PLANT PANELBOARD, FOR EXAMPLE



4 Vapor-pressure thermometer consists of a bulb, tubing and bourdon spring containing a volatile liquid. Whether bulb is hottest part of system (*A*) or line and spring are hotter, free liquid surface is in bulb and true temperature is shown



5 Resistance thermometer consists of an indicator, which is a calibrated deflection galvanometer in a wheatstone-bridge circuit, a temperature-responsive element, or bulb, and 3-conductor cable connecting the indicator and the bulb

Effective, properly controlled cooling insures engine safety. This means indicators to tell you how the system's behaving and automatic devices to keep it on the beam. Here's what you need to know to select and install them to the best advantage

be mercury or colored alcohol; latter is easier to read.

Dial thermometers are often preferred for engine use because they're easier to read at a distance, are less liable to breakage, and can be installed with dial at a distance from measuring bulb. Simple dial thermometer of Fig. 2 works on the bimetal principle. Straight form shown employs no pivots, gears or connecting links. It is not, however, adaptable to remote indication.

Many dial thermometers are pressure actuated. They consist of a pressure-measuring device (generally a bourdon spring or bellows) connected through a thin tube to a metal bulb, which is exposed to the temperature to be measured. System is pressure-tight and filled with an expansible medium. When temperature changes, resulting pressure change causes bourdon tube or bellows to expand or contract. This moves a pointer to show temperature change on a calibrated dial.

Liquid or Vapor? On engine-cooling systems, two types of pressure-actuated thermometers are common. One uses a *liquid* such as mercury, and works by volumetric expansion. The *vapor-pressure* type uses a volatile liquid like alcohol, butane or hexane, and works on the change in vapor pressure resulting from a change in temperature. The two types can be readily distinguished: a uniformly graduated dial marks the liquid type, while a dial with progressively wider graduations from low to high end of scale marks the vapor-pressure type. Hence range for vapor-pressure units should be carefully selected so working point falls in upper half of scale. Typical vapor-pressure scale for measuring jacket-water outlet temperature is shown in Fig. 3.

Remote Indication. A pressure-actuated dial thermometer may have a rigid stem for direct mounting, or may connect to its bulb by a flexible tube. Latter scheme is handy when you want to show on an engine operating panel the water temperature in distant accessories, such as heat exchangers. But take care to select and install such units carefully. Here's why:

In liquid-pressure type, temperature changes along the capillary tube introduce errors that must be compensated. By providing a small-bore capillary tube and large bulb volume, such instruments are satisfactory up to tube lengths of about 50 ft.

Line Temperature. Although compensating devices can be applied to liquid-pressure thermometers to give satisfactory accuracy for tube lengths over 50 ft, vapor-pressure thermometers are generally preferred for long runs, up to 200 ft. They are not affected by temperature changes along the tube after conditions reach equilibrium.

As you can see in Fig. 4*A*, as long as bulb is hottest part of system, line and bourdon spring are filled with liquid. If line and spring become hotter than bulb, they fill with vapor. Fig. 4*B*. In either case, however, the free liquid surface is in the bulb and correct temperature is indicated. Just as a blow torch on a steam radiator won't increase boiler pressure, so temperature changes on line and bourdon spring won't change thermometer indication.

Bulb Elevation. But vapor-pressure thermometers must be corrected for either positive or negative bulb elevations unless line and spring remain filled with vapor. But in engine-cooling systems, bulb almost always runs hotter than line, which is thus filled with liquid. Thermometer maker will reset instrument pointer to compensate for hydrostatic head if you furnish needed information when you order.

Resistance Thermometers. Resistance-type electric thermometers, Fig. 5, are useful for long distances. Bulb can be as much as 1000 ft from indicator. Readings are not subject to error from changes in temperature of lead wires, nor from differences in elevation between indicator and bulb. One indicator can readily show temperatures at several points.

These units depend on the fact that resistance of electrical conductors varies with changes in temperature. They consist of: (1) an indicator, which

is a calibrated deflection galvanometer in a wheatstone-bridge circuit, (2) a temperature-responsive element, or bulb, and (3) a 3-conductor copper cable connecting indicator and bulb. The temperature-responsive element is a coil of nickel or copper wire enclosed in a bulb. It forms one leg of the bridge circuit. Low-voltage current from one or two dry cells or a small ac transformer powers the bridge. Fig. 5 shows a circuit diagram.

Before taking a reading, you must balance the bridge circuit. This is easily done by turning knob on adjusting resistor until needle comes to standardizing position. Switching to bulb circuit then shows bulb temperature on the indicator scale.

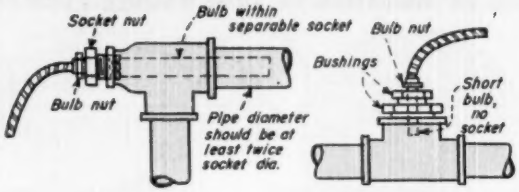
Thermometers for engine-cooling systems should always be selected with ample scale range to take care of maximum conditions, including derangement. Specifically, upper end should be 220 F unless there is no possibility of steam forming.

Installing Bulb. A separable socket enclosing the bulb casing. Fig. 6, is useful. It permits ready removal of thermometer bulb for attention or substitution without interfering with water circulation. It also protects bulb from corrosion and damage.

Best location for a bulb in a pipeline is at a bend or tee, Fig. 7*A*, arranged so bulb projects into flow. This permits using a long bulb and assures flow over its entire surface. Never install a bulb as in Fig. 7*B*. The bulb is short and is in vapor pocket.

Recording Thermometers. In important plants it may be desirable to make permanent records of temperatures in the cooling system. Graphic instruments, employing the same basic principles as the indicators described, are available in many types. Temperatures from several points may be recorded in different-colored inks on the same chart. Such recording instruments help you check operation and spot causes of trouble.

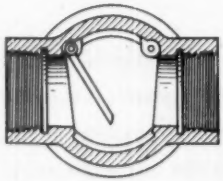
PRACTICAL POINTERS ON THERMOMETER INSTALLATION



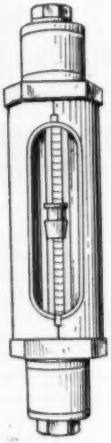
7 Locate thermometer bulb in bend or tee (*A*) so bulb projects into flow. This allows a long bulb and assures flow over entire surface. Never install as in (*B*); bulb is in vapor pocket

6 A separable socket enclosing bulb casing protects bulb from damage and corrosion. It permits removal of the bulb for attention or substitution without interfering with flow of water

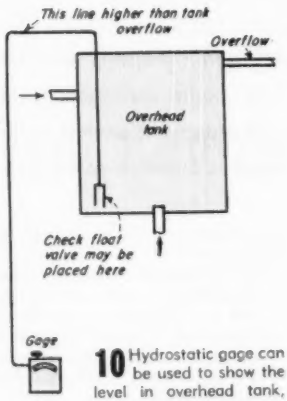
TYPICAL FLOW AND LIQUID-LEVEL INDICATING DEVICES



8 Flow indicator has a pivoted gate suspended in the water. Its angle, seen through glass, indicates flow at glance



9 Simple form of flowmeter has float moving in tapered vertical tube. For each rate of flow it assumes a given position against a scale



10 Hydrostatic gage can be used to show the level in overhead tank, if connected to prevent tank water reaching gage

PRESSURE AND FLOW

Pressure indicators find their main use in engine-cooling systems as: (1) a check on the maintenance of circulation, and (2) a measure of pressure drop through filters, strainers, heat exchangers, etc, to show when cleaning is needed. If water flow stops suddenly, a pressure indicator can show this at once, whereas a thermometer always lags behind. The familiar bourdon-tube pressure gage usually serves the purpose. Pressure recorders can be used to make permanent records but are seldom considered necessary.

Flow indicator, like Fig. 8, has a pivoted gate, suspended in water. Its position shows through the glass window. It is sometimes useful to have this check on water flow, as pressure gage might show almost normal reading due to static pressure.

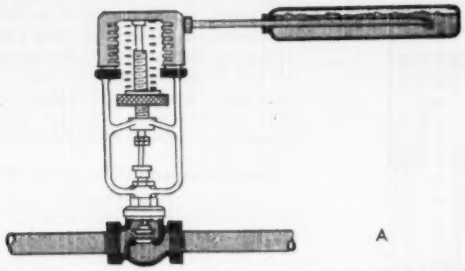
Flow indicators show rate of flow only crudely, if at all. Actual flow rate can be measured by flowmeter, a simple indicating form of which is shown in Fig. 10. Flowmeters are seldom used in engine-cooling systems, however, as temperatures and pressures must be measured anyway and these usually give all information needed.

Liquid-Level Gages. Many cooling systems have overhead storage or expansion tanks. These should not be allowed to empty. Hence liquid-level indicators find use, particularly for inaccessible tanks. Such indicators should be reliable but need not be precise as exact level is not important. A sight glass or simple, homemade float-and-pulley arrangement may be used if tank can be seen. You can employ a hydrostatic gage, Fig. 10, if you connect it to prevent tank water from reaching gage. A properly calibrated pressure gage will also fill the bill. Connect it to the tank by an independent pipe to avoid errors from flow effects.

AUTOMATIC VALVES

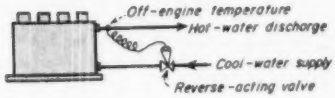
Formerly, temperature and pressure indications guided the operators, who then manipulated the necessary valves to control water flow, etc. Most modern plants employ automatic control devices.

THERMOSTATIC VALVES REGULATE WATER FLOW IN RESPONSE TO TEMPERATURE CHANGE

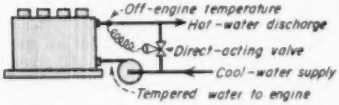


11 Thermostatic valve consists of temperature bulb, tubing and bellows-actuated valve. System contains volatile liquid. Diagram *(A)* shows valve wide open. As temperature rises, volume of liquid in bellows chamber increases. This pushes bellows and stem down against spring. Valve disk moves toward seat. The second drawing *(B)* shows valve in closed position

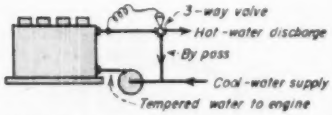
VALVE APPLICATIONS



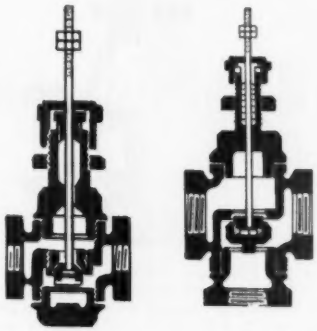
12 Reverse-acting valve in water supply line opens as temperature rises, increasing rate of flow through engine



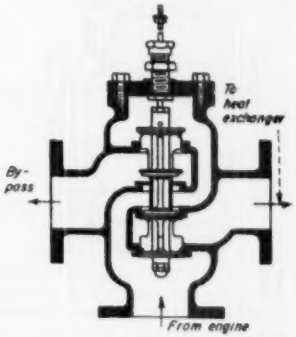
13 Direct-acting valve in bypass closes as temperature rises. This reduces flow of hot water through bypass, lowering temperature of mixture to the engine



14 In bypass hookup with 3-way valve, temperature rise causes valve to divert less hot water through bypass, reducing temperature of mixture to engine



15 Reverse-acting valve is used in a hookup like Fig. 12, at *left*



16, 17 In bypass hookups, Fig. 14, 3-way valves find use. They may be single-seated, *left*, for small sizes and moderate pressure drops, or balanced, *right*

Advantages of such automatic controls are: (1) They save operators' time. (2) More uniform temperatures are maintained. (3) Higher off-engine temperatures are permissible, giving higher efficiency. (4) Warm-up time is cut, so lubrication is improved. Of course, many manual valves—usually of the gate type—are still used for bypassing, shutoff, etc.

Automatic valves controlled by temperature are called *temperature regulators, thermostatic valves, thermostats*, etc. If controlled by pressure, they may be called *pressure regulators, pressure-static valves*, etc. As used in engine plants they are usually *self-operated*, needing no auxiliary power.

Valves and dampers are, however, sometimes actuated by electric or pneumatic power, especially where large operating forces are needed.

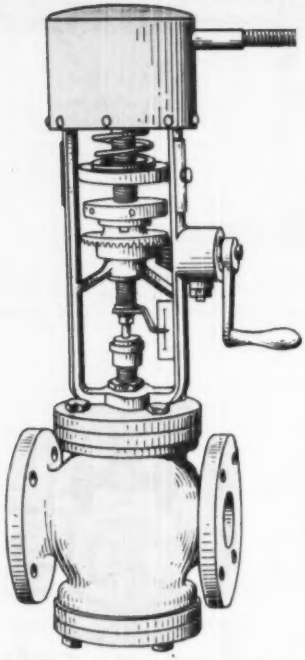
Thermostatic valve consists of a valve and a temperature element or bulb similar to that used in vapor-pressure temperature indicators. Bulb is larger to provide more force. Operation of such a valve for bypass control, Fig. 13, is shown schematically in Fig. 11. Note that pressure generated in bulb by rising temperature is transmitted to bellows chamber by liquid, not vapor. Drawings *A* and *B* show wide-open and closed positions, respectively, but valve disk is usually in some intermediate position. When temperature rises, volume of liquid in bellows chamber increases. This pushes down head of bellows and stem against resistance of spring. Valve disk thus moves toward seat. Reduced water flow through bypass starts to lower water temperature, which in due time reduces vapor pressure in bulb, causing bellows pressure to reach a balance with spring pressure. Valve disk comes to rest in partly open position proportional to temperature.

Direct or Reverse? Valve just described is called *direct-acting*, because increase in temperature tends to close valve. Such valves are useful only on bypasses, Fig. 13, where rising temperature calls for less flow through bypass. When valve is in pipe directly supplying the engine or heat exchanger, Fig. 12, it must open when temperature rises. This calls for a *reverse-acting* valve, Fig. 15, in which movement of stem caused by increasing volume in bellows chamber opens valve.

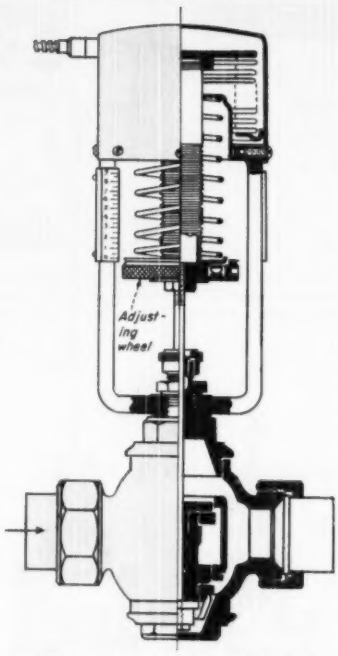
Use of a double seat is common practice on all but small thermostatic valves. It balances pressure on valve disks, reducing needed actuating force and increasing sensitivity. This permits a smaller thermal system.

Three-Way Valves. Actuated by similar thermal systems, 3-way valves

THESE THERMOSTATIC VALVES MEET SPECIAL CONDITIONS



18 This valve has a manual operator so it can be opened, closed or positioned if its thermostat becomes inoperative



19 This valve has thermostatic system under subatmospheric pressure so it fails "safe" (open) if the fluid is lost

direct water flow to cooler or through bypass in required ratio. This type of control, diagrammed in Fig. 14, is more positive than the straight-through hookup. For small sizes and moderate pressure drops the single-disk 3-way valve of Fig. 16 serves; the balanced design of Fig. 17 handles larger flows and permits higher pressure drop. One 3-way valve has the thermostatic element in the valve body.

Types of Operation. The automatic valves described so far have been the *modulating* type. When temperature (or pressure) changes, valve disk starts to move in proper direction but usually does not reach its limit of travel before motion is arrested by return of temperature to normal. In general, modulating valves may be of two types: in *floating* designs final disk position bears no fixed relation to temperature but changes continuously, or "floats," as temperature deviates from control point; in *proportional-position* designs, disk position always bears a direct relation to temperature.

Self-operated thermostatic valves of vapor-pressure type always work on the proportional-position principle. Auxiliary-powered thermostatic valves are available in both modulating types and also in 2-*position* designs. As the name implies, 2-position valves are either open or shut and do not take intermediate positions. Either the floating or proportional-position type should be chosen to prevent hunting. In general, the floating type, which usually costs less, proves adequate for engine-cooling systems, as little or nothing is gained by greater refinement.

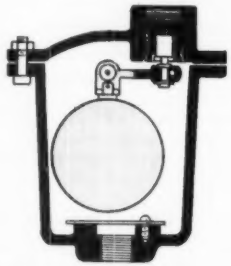
Safe-Failing Valve. Since bellows pressure in reverse-acting valves opens valve when temperature rises, loss of thermostatic fluid due to a break or leak will cause valve to close and shut off water to engine or heat exchanger. One maker protects against this by the "safe-failing" design of Fig. 19. Here thermostatic system is charged with fluid that is always below atmospheric pressure. Spring pushes down on valve stem instead of up. Spring force downward is balanced by fluid force upward (because of subatmospheric pressure in bellows). Hence, if fluid is lost by accident, spring pressure downward is unopposed and valve opens wide, assuring full flow.

Thermostatic bulbs of the vapor-pressure type should always be mounted so thermostatic liquid is trapped in bulb by internal pipe. Install bulb at a point where temperature is truly representative and circulation is good. Don't put bulb where inadvertent closing of a valve can stop water flow past bulb! If you use a thermometer, place its bulb next to the valve's.

Pressure Control. For the relatively few cases where pressure-controlled valves are needed in engine-cooling systems, the types used generally in industry serve the purpose. *Pressure-regulating* valves, for example, sometimes maintain a fixed pressure on a manifold system supplying several engines. *Pressure-reducing* valves find occasional use between city mains and engine-cooling system for emergencies when pressure in engine system falls below normal. With such a hookup, be sure you shut off city water manually when engine is stopped.

Pressure-relief valves are needed in a few special applications: (1) On electric water heaters that prevent freeze-ups of cooling system when engine is shut down in cold weather, relief valve prevents damage if operator fails to open valves on heater when turning on current. (2) On reciprocating or gear pumps, it prevents damage if pump is started against a closed valve.

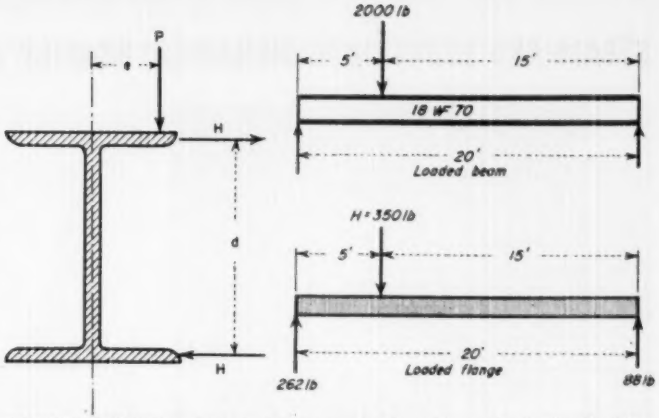
Air-Release Valves. All water systems tend to collect air, which finds its way to high points. In favorable piping layouts, this air reaches overhead expansion or surge tanks and is freed to atmosphere. It's often impossible to avoid trapping air in some places, however, and manual venting may be forgotten. Hence it's advisable to use air-release valves or vent traps, like those in hot-



20 Float-operated valve automatically vents air trapped in cooling system

water heating systems. A typical design, Fig. 20, contains a float-operated valve. Capacity can be small, as rate of air accumulation is usually low. Air-release valves may spurt a little water, hence outlet may be piped out of way if desired.

Here's an easy way to figure torsional stress in I-beams and wide-flange beams carrying an eccentric load. Since many pipe hangers are loaded eccentrically, Otto Ebel, of Brooklyn, New York, developed this method for speeding hanger-design calculation



STRUCTURAL BEAMS used for pipe hangers can be figured for torsion by "loading" the flanges wtih force *H* and treating them as simple beams in pure bending. See text for complete description of method. Flange reactions, sketch, have been rounded off

Figuring Torsion in Pipe-Hanger Beams

► PIPES SUPPORTED BY I- or wide-flange beams may put an eccentric load on them. This causes a torsional stress in the beam in addition to the normal bending stress. I've developed a way for figuring this torsional stress, which is simple and will interest piping designers.

My method is based on one published by P W Werner in 1935 in the *ASCE Proceedings*. I also use torsional constants from Bethlehem Steel Co's Booklet S-57, *Torsional Stresses in Structural Beams*. Here's how it works.

Werner considers twist resistance of I- and wide-flange beams to consist of two actions. Part of the moment is resisted by the beam flanges acting as horizontal beams and part by the entire beam section in torsional shear.

To find torsional stress the flange is "loaded" as a simple beam with a force, H, found from $H = Pe/d$, where P = load on beam, lb; e = load eccentricity, in.; d = distance between center of gravity of flanges, in. Resulting moment is multiplied by a correction factor, K, to obtain bending in flanges caused by torsional moment Pe. Correction factor $K = (tanh\ c) \div c$, where $c = L/2a$; L = beam span, in.; a = torsional constant from Booklet S-57.

I've computed values of K for various values of c and listed them in the table.

Example. Assume we've loaded a wide-flange beam as in sketch. A 2000-lb load is supported on the flange 3 in. from the vertical axis of an 18WF70 beam. Span is 20 ft, load being 5 ft from left end of beam. What is the flange stress caused by torsion and what's the total stress in beam?

Solution. Flange load $H = Pe/d = 2000(3)/17.3 = 350$ lb, closely. Using Bethlehem's torsional constant, $c = L/2a = 240/2(67.6) = 1.775$, and K from the table is 0.532.

When flange load is applied to the beam, reaction at left support is 262 lb, that at right is 88 lb. See sketch. Now the lateral flange moment is $262(5)(12)(0.532) = 8400$ in. lb, closely.

Since stress equals bending moment divided by section modulus, we divide the lateral flange moment by the section modulus of the beam flange about its vertical axis. Thus using a structural-steel handbook to find flange section modulus, torsional stress $= 8400/8.95 = 940$ psi. Total stress in beam caused by pure bending and torsion is the sum of the two, or $700 + 940 = 1640$ psi.

Procedure. There are several items you must note when applying this method. First, it is approximate. If you use the formulas in Bethlehem's Booklet S-57, the torsional bending stress is 1090 psi instead of our 940 psi. This difference is generally not serious and the saving in time justifies use of my method. Formulas are necessary only when exact results are desired.

When computing torsional stress I used one half of the tabulated value for the section modulus of the beam about its vertical axis. This is valid because the moment of inertia of one half the web about the vertical axis is negligible for this beam.

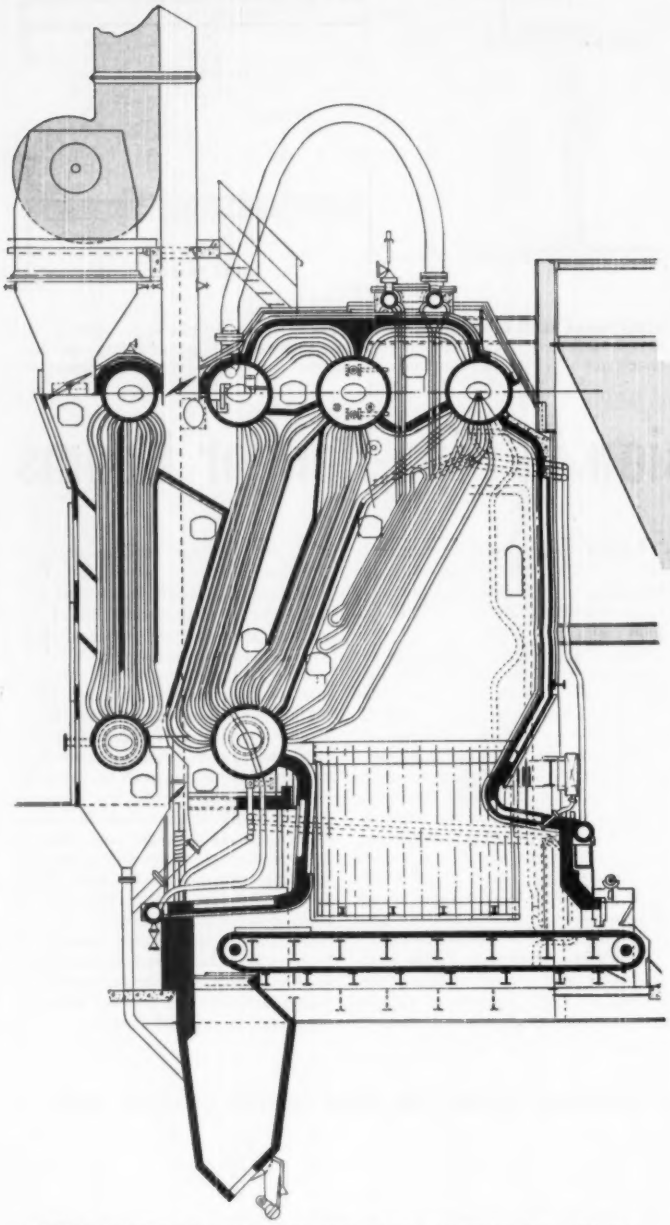
Beam was assumed to have free ends. When ends are fixed my method can't be applied. Since many piping hangers have free ends you can use this system to solve your problems. I believe it is much easier than formulas.

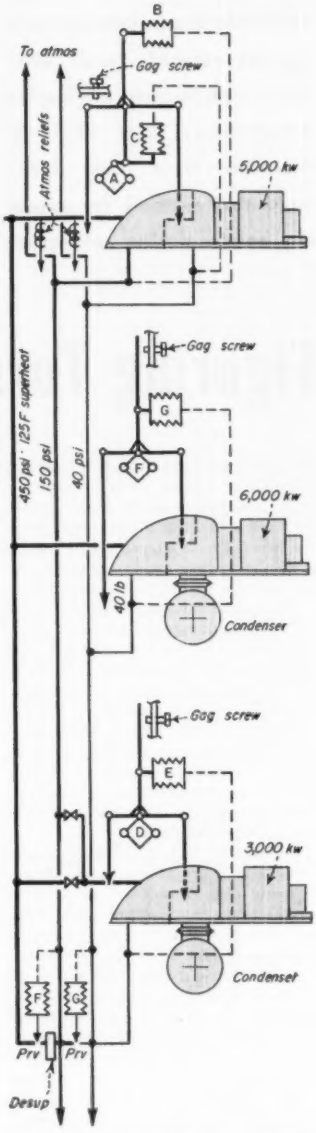
Note, also, that stress from pure bending is found in usual manner. This requires no explanation because most piping designers are familiar with the equations and constants used.

CORRECTION FACTORS FOR BEAMS CARRYING ECCENTRIC LOADS

c	K	c	K	c	K	c	K	c	K
0.2	0.987	2.2	0.444	4.2	0.238	6.2	0.161	8.2	0.122
0.4	.950	2.4	.410	4.4	.227	6.4	.156	8.4	.119
0.6	.895	2.6	.380	4.6	.217	6.6	.152	8.6	.116
0.8	.830	2.8	.355	4.8	.208	6.8	.147	8.8	.114
1.0	.762	3.0	.332	5.0	.200	7.0	.143	9.0	.111
1.2	.695	3.2	.311	5.2	.192	7.2	.139	9.2	.109
1.4	.632	3.4	.293	5.4	.185	7.4	.135	9.4	.106
1.6	.576	3.6	.277	5.6	.179	7.6	.132	9.6	.104
1.8	.526	3.8	.263	5.8	.172	7.8	.128	9.8	.102
2.0	.482	4.0	.250	6.0	.167	8.0	.125	10.0	.100

STEAM AND ELECTRIC GENERATION READILY HANDLE LOAD SWINGS...



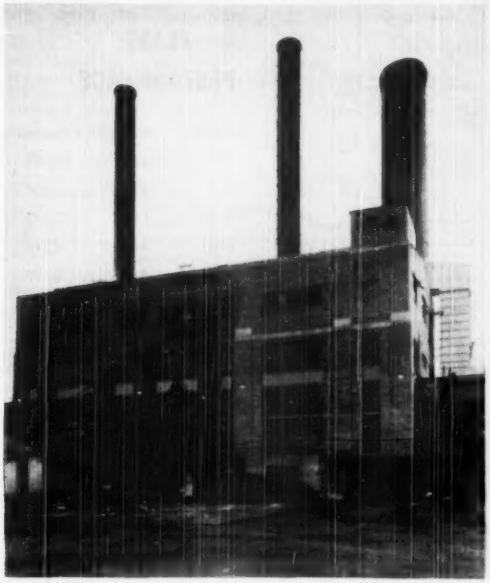


OHIO BOXBOARD'S DESIGN FOR RANGE OF FUELS

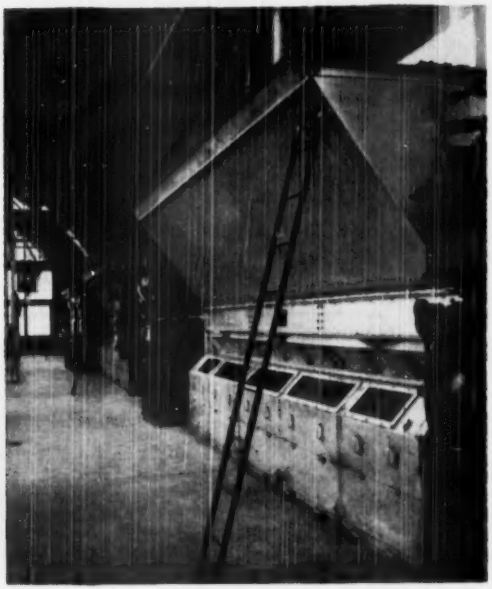
1 One of the most important decisions made back in 1934 was the selection of boiler and firing method. This design could fire a coal, then and still available in ample quantities in the local market, with a number of similar coals within short hauling distance. The boiler had for those days a very conservative heat release of 32,000 Btu per cu ft per hr. Over the years two additional boilers of the same design have gone in. They employ overfire air fans and steam jets whenever needed

SMOOTH LOAD TRANSFER

2 All turbines have automatic extraction pressure governors so that load transfers from machine to machine can be made smoothly, efficiently. Together with pressure-reducing valves, Fig. 5, system is highly flexible for changing demands



3 Initial power-plant building and its latest extension shows above. The plant was located to allow for growth



4 Traveling-grate stoker has overfire air up to 15% of total, fed through seventeen 2-in. nozzles at 10-in. wg pressure

Initial Design's Flexibility Pays Off

Ohio Boxboard picked up all savings it could with a modernized plant in 1934; but they saw beyond, selected a design that still is good

By **JOHN H BALDWIN**, *chief engineer, power div, Ohio Boxboard Co*
W F COLES JR, *mechanical engineer, H M Wilson Co*

► PLANNING FOR THE FUTURE is one of the fundamentals of good design. Everyone recognizes, however, that a lot of factors can upset the best of plans. One is war. So when you come across a plant whose basic design has proved sound through depression, war and postwar expansion, it is well worth a second look.

Back in 1934, Ohio Boxboard Co. of Rittman, Ohio, found they could save considerable money by modernizing the power plant. Right then and there they set in motion a course of action that still holds good.

At that time their boxboard production averaged 10 to 12 tons per hr. It took 180,000 lb per hr of 160-psi steam, 3600 kwhr of electrical energy to produce this amount. The most immediate savings came from a high-pressure 450-psi steam generator supplying a 3000-kw single-extraction condensing turbine. The remaining 700 kwhr were purchased from the local public utility.

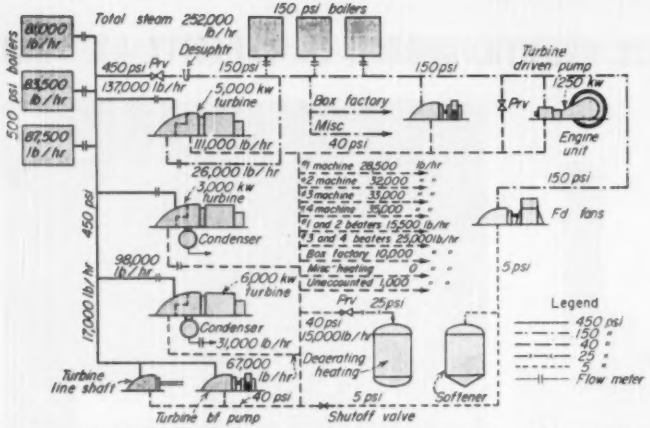
One of the most important decisions the company made at that time was the type of boiler and the firing method. Those were the days when good coal could be had, and at attractive prices. But they looked beyond the immediate present. They selected a boiler installation that could fire an Ohio No. 5 and 6 strip-mine bituminous coal of this analysis: moisture, 9.5%; volatile matter, 36.5%; fixed carbon, 41.5%; ash, 12.5%; sulfur, 3.5%; heating value, 10,600 Btu per lb.

Why this fuel? There were a number of sound reasons behind their choice. Reasons as good today as in 1934. This coal was available in ample quantities, at very reasonable prices. Further, similar coals could be substituted from fields within fairly short hauling run.

The boiler chosen then and duplicated twice since is a 4-drum, bent-tube design, Fig. 1, with watercooled walls. It has a steaming capacity of 120,000 lb per hr at 450 psi, 668-F total temperature. Furnace volume for each totals 5225 cu ft. Heat release at normal rating is 32,000 Btu per cu ft per hr.

Each unit has a traveling-chain-grate stoker and under certain firing conditions makes use of overfire air fans and steam jets. Stoker measures 20 ft, 3 in. long, 18 ft, 6 in. wide, and has a grate area of 375 sq ft.

Power Requirements. How has this initial choice worked out? Best way to answer this question is to trace plant development and experiences over the



5 Steam-flow diagram shows how all steam-generating units tie in with steam-using equipment. Turbines' extraction points plus reducing valves meet demand swings

PLANT PERFORMANCE

	Tons/hr	Kwhr	Lb steam/ton
1934	10.0	3600	18,000
1939	16.1	5750	15,000
1941	17.5	6700	13,220
1943	17.7	7400	12,270
1948	18.5	8400	12,190
Future	25.0	12,000	13,000

years. Table above shows at a glance what's been happening.

Rate of producing paperboard has gone steadily up from a 1934 figure of 10 tons per hr to 18.5, with an expected 25 in the future. The day's totals have also climbed from 240 tons in 1934 to 444, and a proposed 600.

What has this growth meant to the power services and the power plant? Electrical-energy requirements measured in kwhr go from 3600 back in 1934 to 8400 in 1948, and a possible 12,000 in the future. Installed electrical equipment in terms of kw per ton of paperboard has jumped from 360 in 1934 to 438 in 1948, and may go to 475 in the next step.

Yet the steam demand in lb per ton has steadily dropped. In 1934, it required 18,000 lb of steam for every ton of paperboard turned out. By 1948, only 12,190 lb were needed.

Growth in electrical demand per ton of paperboard output follows an almost industry-wide trend toward greater use of electricity, not only for drives but for controls as well. Replacement of many of the old steam drives accounts in some measure for the drop in steam rates per ton of output. But a large share of the steam savings come from higher-pressure steam, more flexible steam supply through interconnections, pressure reducing valves, Fig. 5, and other steam-system economies.

Let's take a closer look at the major changes in the power plant and see (1) what prompted the changes and (2) what results they effected.

In 1941, mill production reached 17 tons per hr, electrical energy had jumped to 6800 kwhr from 3700. And of this 3700, the local public utility supplied 700. So the crying need was for more electrical-generating capacity. A second high-pressure boiler like the first went in, along with a 5000-kw single-extraction backpressure turbine-generator.

This backpressure turbine unit exhausted at 40 psi and had its single extraction point at 150 psi. It was designed primarily to give a low-cost electrical energy at the busbar and yet supply steam for process at 150 and 40 psi.

Saving in purchased power alone amounted to $44,000 per year. Coal savings, due to the higher quantity of steam generated in the low-cost chain-grate high-pressure boiler, reached about 19%, a yearly fuel-bill saving of $37,500.

When war ended in 1945 the management felt the mill should be expanded to produce an average of 22 tons per hr with short peaks up to 25 tons per hr.

So the third major step in the power program was taken. Another high-pressure boiler of the same capacity, 120,000 lb per hr, and design, Fig. 1, was put in. A 6000-kw single-extraction condensing turbine-generator was added. All the necessary duplicating equipment, such as coal conveyors, crushers, fans, Table, p 101, went in.

Water Problems. Added boiler capacity as well as production needs put a heavy load on well-water supply. In addition, the condenser made it necessary to take steps toward insuring enough condensing water at all times. During drought periods, normal creek level falls off and is quite low. Condenser cooling water is then recirculated between reservoirs.

But to make sure condenser cooling-water temperature stayed below the point where machines would lose vacuum, one reservoir was converted to a spray pond. Here 4500 gpm can be sprayed. Then the remainder of the 8000 gpm needed for cooling is drawn from cold well water.

Raw water for all services—boiler feed, condenser cooling, process—comes from deepwells. It has a hardness from 12 to 15 gr per gal. That portion slated for boiler service goes through filter beds and then through a hot lime-and-soda softening system and then through filters. The treated water as makeup (roughly 30% of total feedwater) enters a deaerating heater and joins with the condensate return. A supplementary phosphate treatment is added directly to the boiler drums.

Boiler Operation. Original selection of fuel and firing method has worked out far better than anticipated. Outages have been extremely rare. Maintenance has been almost negligible. At last check the stoker on the first boiler had burned better than 700,000 tons in its operating life. This life has been one of practically continuous service with maintenance limited to installation of grate links. Here's how the stoker operates.

Overfire air is introduced above the ignition arch by seventeen 2-in. nozzles at a pressure of 10-in. water. Air entering the furnace in this way amounts to about 15% of total air. At high steaming rates, steam jets work along with the overfire air to develop a better turbulence.

One boiler easily carries an overload of 15 to 20,000 lb per hr. On occasion it has picked up load increases up to 50,000 lb per hr almost instantly.

The three boilers in combination were put under an extensive test recently. No special preparation was made nor were any extraordinary firing methods used. The regular firemen operated in their regular way. Results showed an aver-

PRINCIPAL POWER-PLANT EQUIPMENT

Ohio Boxboard Company, Rittman, Ohio

STEAM-GENERATING EQUIPMENT:

Boilers, 3 ..... Babcock & Wilcox Co
120,000 lb per hr, 450 psig, 668 F at superheater outlet, 5225 cu ft furnace volume, 13,836 sq ft boiler heating surface, 1254 sq ft effective waterwall surface

Economizer, 1 per boiler ..... Babcock & Wilcox Co
Two-drum, integral, 5540 sq ft heating surface

Stoker ..... Babcock & Wilcox Co
Forced-draft chain grate, 375 sq ft

Soot blowers ..... Diamond Power Specialty Corp

Forced-draft fans, 1 per boiler ..... American Blower Corp
6—½ double inlet, vane control, 55,000 cfm, 80 F, 5 in. wg, 1160 rpm

Induced-draft fan, 1 per boiler ..... American Blower Corp
8—⅝ double inlet, 112,000 cfm, 500 F, 7.3 in. wg, 685 rpm

Overfire air fan, 1 per boiler ..... American Blower Corp
400 double inlet, 6000 cfm, 70 F, 10 in. wg, 1750 rpm

Overfire steam jets ..... Joyaness Engineering Co

Nonreturn valves ..... Lunkenheimer Co

Feedwater regulator ..... Northern Equipment Co

Suspended boiler arch ..... M. H. Detrick Co

Combustion control ..... Bailey Meter Co

Coal-handling equipment ..... Gifford-Wood Co

POWER-GENERATING EQUIPMENT:

Turbine-generator, 1, 6000 kw ..... General Electric Co
7500 kva, 3600 rpm, 2400 volts, 450 psi, 125 deg superheat throttle, 40-psi extraction, condensing, direct-connected, 40-kw exciter

Condenser, 1 ..... Westinghouse Electric Corp
6500 sq ft, 1840 tubes

Circulating pumps, 2 ..... Westinghouse Electric Corp
4100 gpm each, 75-ft head, 1160 rpm, motor-driven

Condensate pumps, 2 ..... Westinghouse Electric Corp
150 gpm each, 150-ft head, 1750 rpm, motor-driven

Steam-jet air ejectors, 2 ..... Westinghouse Electric Corp
2 stage, combined with inter- and after-cooler

Turbine-generator, 1, 5000 kw ..... General Electric Co
6250 kva, 3600 rpm, 2400 volts, 450 psi, 125 deg superheat throttle, 150-psi extraction, 40-psi backpressure, direct-connected exciter

Turbine-generator, 1, 3000 kw ..... General Electric Co
3750 kva, 3600 pm, 2400 volts, 450 psi, 125 deg superheat throttle, 40-psi extraction or admission, condensing, direct-connected exciter

Condenser ..... Ingersoll-Rand Co

Electrical switchgear ..... General Electric Co
Type MI-6 vertical-lift metalclad, 150,000-kva interrupting rating—2300 volts, operating level

age 3-boiler efficiency of 80.4% with a 10,620 Btu coal, and at an evaporation rate of 7.85 lb of steam per lb of coal.

Each boiler has a 2-drum economizer that increases the efficiency about 4%. During low-load operation some of the hotter gas can be routed around the economizer by a bypass damper.

At one time these economizers experienced external corrosion attacks on the tube metal. Steam pressure in the deaerating feedwater heater was picked up to 25 psi from 5, and that raised feedwater temperature to 265 F to greatly reduce the corrosion problem. A second aid in solving this problem was to put in a water-distributing manifold in the bottom economizer drum. As a further precaution tubes are kept free of soot.

Instruments and Controls. From the original planning stage proper instrumentation was pushed. All necessary steam and water flows for the entire plant are metered and recorded. Six-point potentiometers record operating temperatures for each of the three boilers.

In addition, certain checks and tests are made regularly. A daily power-plant economy report carries all metered data. The average evaporation rate per lb of coal appears, as well as a steam-balance check that shows where steam goes and the amount unaccounted for. A daily graph pictures total production of paperboard, kwhr per ton board, total steam per ton of board, and steam metered to each paper machine and beater room. Steam-flow diagrams are made weekly. The graph together with the flow diagram allows a ready check on trends and efficient use of generated steam.

Average boiler efficiency is determined monthly from coal weights, total steam generated, and average heating value of coal used. A composite coal sample comes from individual samples taken from each stoker hopper, once each shift and stored in air-tight cans.

Then the accounting department gets information important to it so it can compute steam costs per 1000 lb, power costs per ton of board produced, lb of steam per ton of board, and lb of coal per ton of board.

Electrical Generation. With the recently added boiler and turbine-generator capacity all present loads can be comfortably met. Usual practice involves using the 5000-kw unit and either of the condensing units, Fig. 2. The third machine serves as a spare or standby for periods of very high demand. The local public utility does not normally tie in, but it can be paralleled on the 2300-v bus for emergencies. At times the plant can sell energy to the power company.

Fig. 2 shows in diagram the governing mechanism of the turbines. All turbines have automatic-extraction pressure governors. For instance, if the 5000-kw machine is base loaded and there comes a change in electrical demand, but with a constant 40- and 150-psi extraction load, the following takes place.

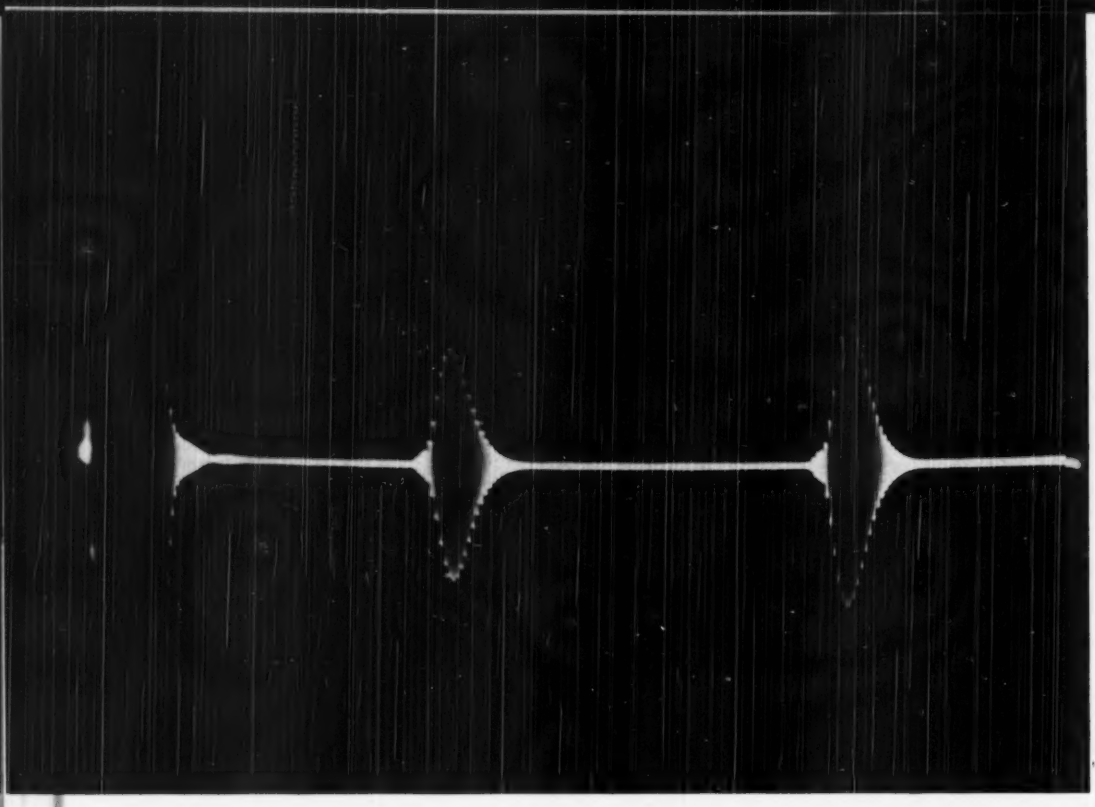
The frequency and turbine speed drop off with a sudden increase in electrical demand. So with the 5000-kw machine the flyball governor raises arm *A*, Fig. 2, and opens both steam inlet and exhaust valves to increase power output momentarily. Any steam-flow rise at the 150-psi extraction point raises the pressure and causes the pressure-governor bellows, *B*, to close down on the inlet valve. This valve closes enough to return extraction steam to its 150-psi level. At the same time the exhaust valve opens to increase the 40-psi flow.

On the 3000- or 6000-kw units the sudden drop in speed causes the speed-governor flyballs to raise arm *D* or *F*, and open inlet and grid valves to increase power output. A rise in 40-psi flow results from this and also from the 5000-kw machine exhaust above. This increased flow raises the pressure and the 40-psi extraction-pressure-governor bellows, *E* or *G*, opens the grid valve farther and passes more steam to the condenser. At the same time the inlet valve closes and reduces flow to compensate for the better water rate. This keeps up until the 40-psi extraction pressure returns to its proper level.

Following this initial sudden change the speed connector on the condensing machine gradually returns machine speed and frequency to its proper level. The 5000-kw turbine also goes back to its original valve position and load. So the condensing machine carries the increased load and passes the additional steam through to the condenser.

With a change in steam demands from either the 150- or 40-psi loads, the extraction governors increase or decrease the flow to the condenser while keeping the electrical output constant. In effect, this automatic governing operation gives the same results as though one condensing turbine were handling the entire load with automatic double extraction.

If the 5000-kw machine were not on the line the 150-psi steam demand could be supplied only through pressure-reducing valves, marked *PRV* on Fig. 5. The governors would then control the 40-psi extraction-steam demand and the electrical demand by changing flow to condenser.

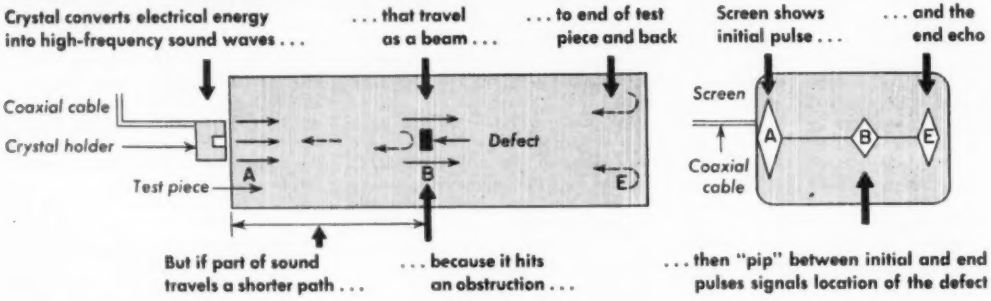


WE SEE THIS PATTERN ON THE OSCILLOSCOPE SCREEN...

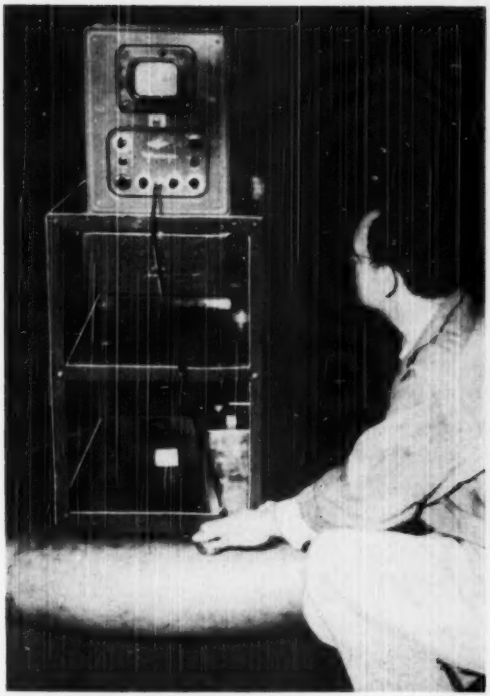
. . . when we inspect with high-frequency sound. Some of sound is reflected by the contact surface and shows up as the initial pulse, *left*. End of piece reflects the sound, causing an end pulse, *right*. The "pip" between them is caused by a defect

Ultrasonics Brings 100% Inspection to

HERE'S HOW ULTRASONIC INSPECTION WORKS

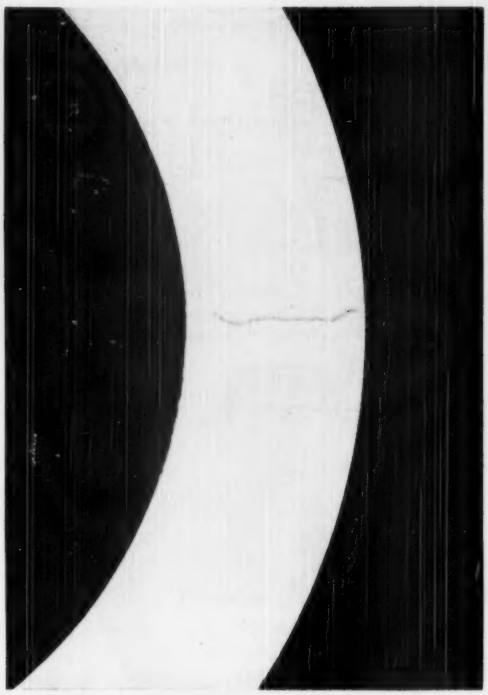

Crystal converts electrical energy into high-frequency sound waves . . .
. . . that travel as a beam . . .
. . . to end of test piece and back
Screen shows initial pulse . . .
. . . and the end echo
Coaxial cable
Crystal holder
Test piece
A
B
Defect
E
Screen
Coaxial cable
But if part of sound travels a shorter path . . .
. . . because it hits an obstruction . . .
. . . then "pip" between initial and end pulses signals location of the defect

CRYSTAL SENDS OUT sound waves, turns reflected sound back to electrical energy; connects by coaxial cable to oscilloscope. Initial pulse appears on screen at *A*. *B* and *E* are reflected pulses. Distance is time needed for sound's round trip



WHEN THE INSPECTOR DETECTS...

. . . a flaw, he marks pipe at that spot. Then he continues his inspection. This picture shows his portable ultrasonic unit



A DANGEROUS, HIDDEN FLAW...

. . . in 6-in. Sched-160 18-8Cb pipe. Not visible on surface, crack was revealed as more than 30 in. long by ultrasonics

Power Piping

Economical enough for production use, high-frequency sound spots hidden flaws before pipe leaves the shop. Here's how a familiar principle goes to work in a new job; what it means to users of high-temperature pipe

By W B BUNN and W J MITCHELL
The M W Kellogg Co

► WHEN A TURBINE LEAD let go in a central station after nine months of operation, attention focused on ultrasonics as a means of detecting flaws in high-temperature high-pressure alloy piping. Experience with high-frequency-sound inspection of heavy forged-steel shafts, together with development of an ultrasonic angle-searching unit, indicated possibilities for 100% inspection of power piping.

The field looked particularly attractive since familiar methods of inspecting welds—radiographic, magnetic-particle or penetrating-oil examination — are either inadequate or too expensive for complete inspection. This has led to a natural reluctance to add to material cost by imposing "super" inspection beyond presently required physical tests of specimens, hydrostatic tests and visual examination.

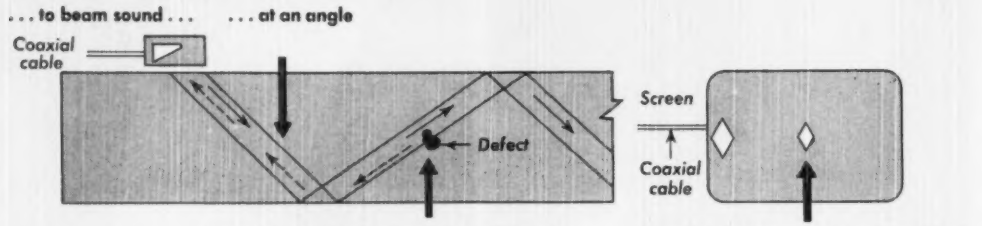
Results from ultrasonic testing have borne out our belief in the method and it has become a production inspection tool at the M W Kellogg Co for power piping, when specified by purchasers.

How It Works. Before going into details of piping inspection, let's take a quick look at ultrasonic inspection in general. Ultrasonic waves* are vibrations of a frequency above normal human-hearing range (about 20,000 cycles per sec). Frequencies of 20,000 to 100,000 cycles are used for sound ranging, submarine signaling, etc. Those of 100,000 to 10,000,000 test materials for flaws. Pulsed systems for measuring distances are about 40 years old, but testing of materials followed a patent issued to Dr F A Firestone in 1942.

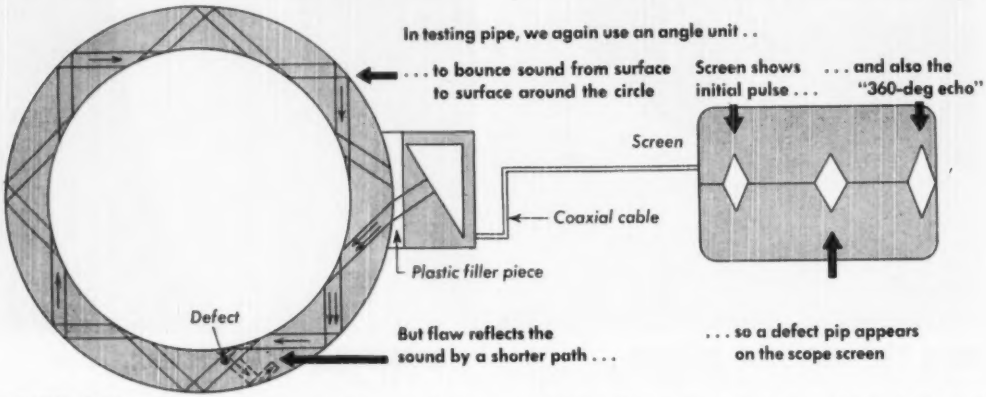
Dr Firestone called his instrument the *reflectoscope*. Sperry Products, Inc has developed it into a convenient portable tool. General scheme of operation is diagrammed at left. Briefly, a suitable crystal changes electrical energy into ultrasonic energy, and transmits into the work a pulse of vibrations that passes through the material as a beam. Any flaw in its path, or the boundary of the material opposite its entrance,

*ULTRASONICS, Benson Carlin. McGraw-Hill Book Co, 1949

ANGLE-SEARCHING TESTS THIN PLATES AND PIPE WALLS


In testing thin materials, we use an angle unit . . .
. . . to beam sound . . .
. . . at an angle
Coaxial cable
Defect
Screen
Coaxial cable
. . . if sound hits a defect, it's reflected to crystal . . .
. . . and defect's location shows on screen

TESTING THIN MATERIALS poses a problem because pulses run together on screen. Angle searching, as shown above, avoids this difficulty. Normally sound waves are not reflected back to crystal so there is no end pulse. Flaw shows up as a pip


In testing pipe, we again use an angle unit . .
. . . to bounce sound from surface to surface around the circle
Screen shows initial pulse . . .
. . . and also the "360-deg echo"
Screen
Coaxial cable
Plastic filler piece
Defect
But flaw reflects the sound by a shorter path . . .
. . . so a defect pip appears on the scope screen

IN PIPE WALLS, angled sound waves travel from surface to surface making full 360-deg trip if there are no defects. If sound hits a flaw, it travels back to crystal by shorter path and makes an intermediate pip between initial and end pulses

reflects the beam. The reflected pulse, or echo, can be picked up by a crystal (either the sending crystal or a separate one) which reconverts the sound pulse to electrical energy. Both the initial pulse and the return pulse appear on an oscilloscope screen.

Normally, in straight-wave testing, the initial pulse appears at the left and the echo, or "end reflection," at the right. The echo from a flaw shows as a "pip" between them. Its relative position between the initial and end pulses on the screen is proportional to the location of the flaw between the end surfaces of the test piece.

Angle-Searching. Such a straight-through beam can test usual materials up to a thickness of 25 to 30 ft. But its reliability is greatly reduced in testing materials less than one inch thick because of the difficulty of separating the pulses on the oscilloscope screen. To overcome this difficulty, Sperry Products developed an angle-searching unit. This transmits vibrations into the material at an angle (see sketch above). In material without defects, the sound beam bounces away from the sending unit and no end reflection appears on the screen. A flaw provides a reflection surface to return the sound to the searching unit*. Because the sound travels as a beam, the searching unit, or *transducer*, must be moved across as well as along the surface to assure coverage of the material's thickness. Amount of cross movement depends on material thickness.

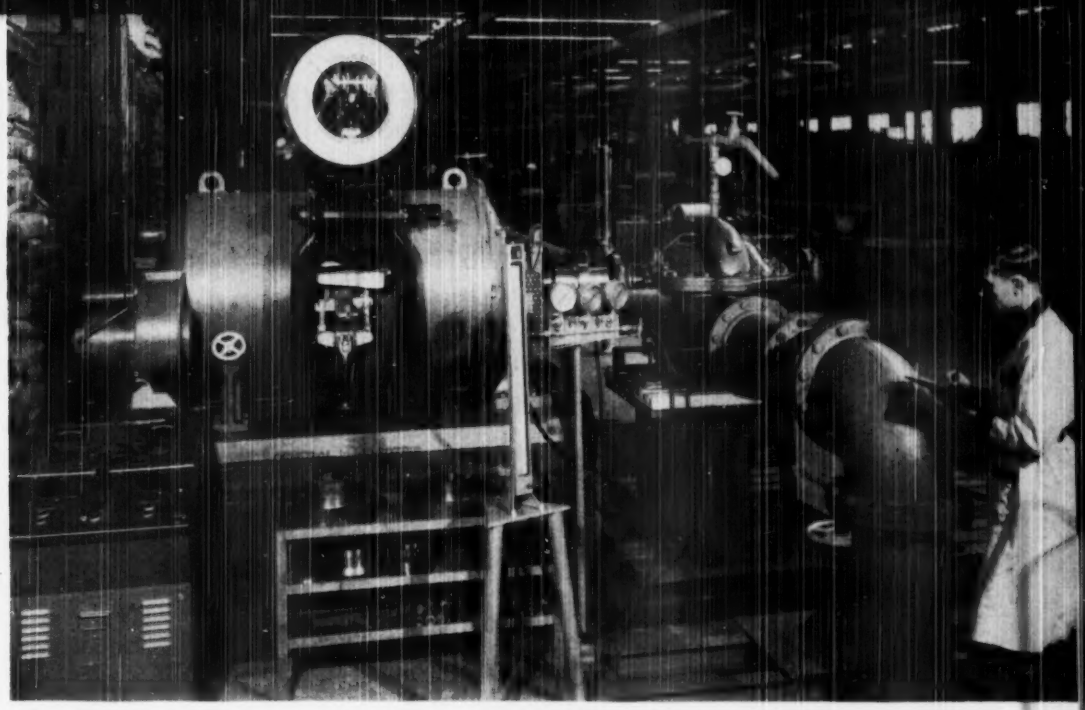
Pipe Inspection. It is this angle-searching method that is currently used in pipe inspection, as shown above. A plastic filler piece of proper shape produces needed good contact on pipe surface. The beam reflects from inside to outside surface for 360 deg, and re-enters the sending crystal with enough energy to furnish a scope signal similar to the end reflection in straight searching.

A defect reflects sound back to the sending-receiving crystal by a shorter path and so produces a pip between initial pulse and end reflection. If defect happens to be 180 deg away from crystal, its reflection signal is superimposed on the end reflection, since it also travels 360 deg.

Pipe may be turned during inspection, while the transducer travels axially, or the operator may sweep the transducer around the pipe in 90- or 180-deg arcs while moving it along the length. This circumferential method of searching with the angle beam is very sensitive because of the nature of the shear wave generated. Indications of defects are readily seen since the signal, or pip, moves across the screen from initial pulse to the reflection signal as the defect travels away from the transducer. It moves in the opposite direction if the defect moves toward the transducer. The defect pip will be about in the center of the oscilloscope sweep when the defect is 90 deg away from the transducer. In this location, the sound beam must travel 90 deg to the defect and return.

(*Continued on page* 164)

*"*Ultrasonic Flaw Detection in Pipes by Means of Shear Waves*, C. D. Moriarty, Fall Meeting, ASME, Worcester, Mass, Sept 19-21, 1950



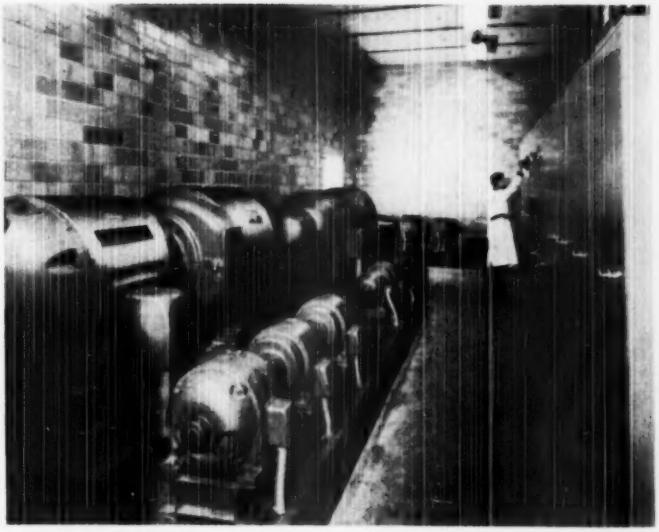
TEST STATIONS: This centrifugal pump is undergoing tests to determine its performance as to head, capacity, horsepower and efficiency. This station includes an electric dynamometer, control desk, suction gages and discharge-pressure gages

500,000-gal Pump-Test Laboratory

For tests of vertical- and horizontal-shaft centrifugal pumps up to 86,000-gpm capacity, this $250,000 laboratory has eight test stations and a 500,000-gal water tank

► MANY INNOVATIONS in advanced techniques and equipment mark a new pump-testing laboratory to insure peak product quality and guarantee matching for exceeding customer requirements of pump performance.

This laboratory, recently completed by Peerless Pump Division of the Food Machinery and Chemical Corp in Indianapolis, cost over $250,000. It occupies more than 7000 sq ft of floor area and has eight pump-testing stations. Both high- and low-voltage equipment are available, making possible use of motors up to 1000 hp.

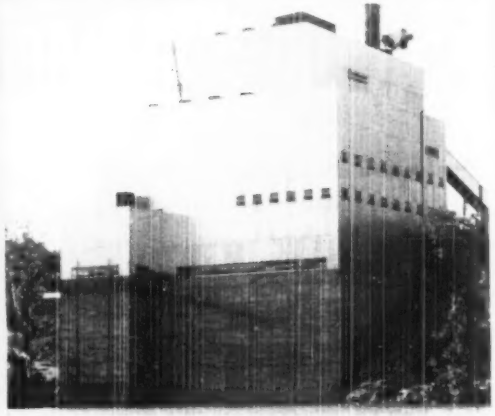


MOTOR GENERATORS: The machines in this room supply dc for pump testing. The 200-kw generator on the left and the one in the back power all the dynamometers

For more pump-test data, turn to page 108

RILEY steam generating and Riley pulverized coal equipment was selected for the new Riverton Station of the Northern Virginia Power Co. Because of the outstandingly satisfactory and efficient performance of Riley steam generating units, Riley units are being installed by many of the country's leading power companies.

Users of Riley equipment will assure you that you will also be very happy with Riley equipment and Riley's handling of your contract, when you join the very definite swing to Riley by power and industrial companies. The performance of Riley equipment in plants warrants a thorough investigation of this equipment by you when you are considering the installation of boiler or fuel burning equipment.



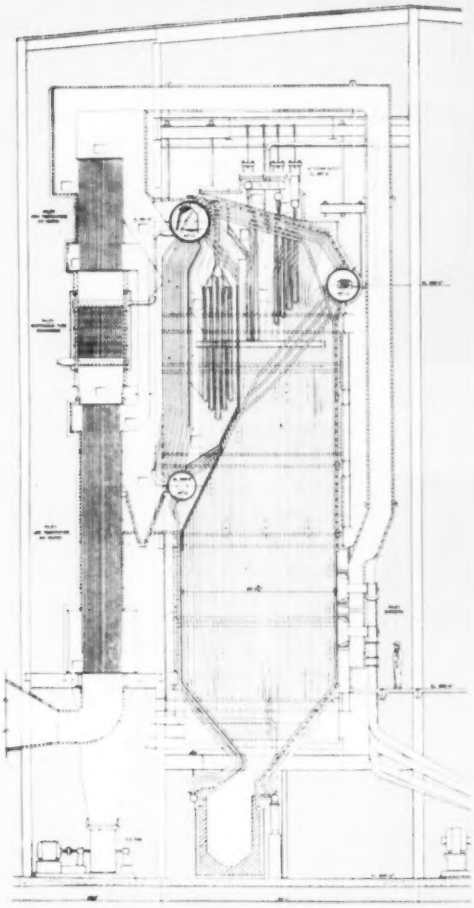
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

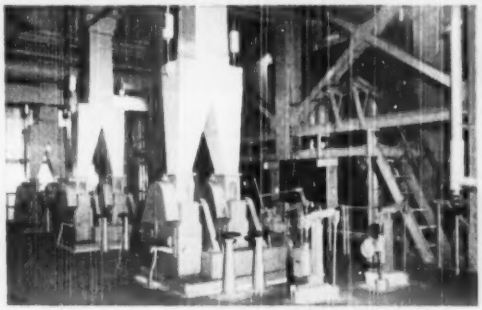
BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · FLUE GAS SCRUBBERS

RILEY CENTRAL STATION PLANT

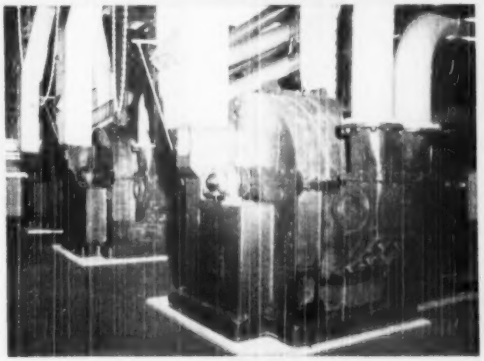


Northern Virginia Power Co., Riverton Station
Winchester, Va.
Sanderson & Porter, Engineers
350,000 lbs. /hr. 1,100 lbs. pressure, 900°F.
fired by Riley Pulverizers and Burners.

Steam Capacity	350,000 lbs. /hr.
Pressure Superheater Outlet	875 psig.
Steam Temperature	900°F
Boiler Surface	14,210 sq. ft.
Water Wall	12,670 sq. ft.
Air Heater	59,000 sq. ft.
Economizer	4,000 sq. ft.
Furnace Volume	21,170 cu. ft.
Heat Release	20,800 B.T.U.
Efficiency	86.6%



View of operating floor showing Riley pulverized coal feeders and burners.



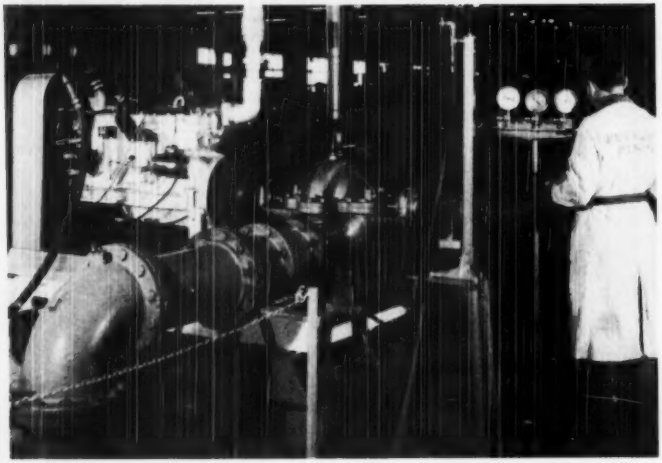
View of the three Riley pulverizers.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

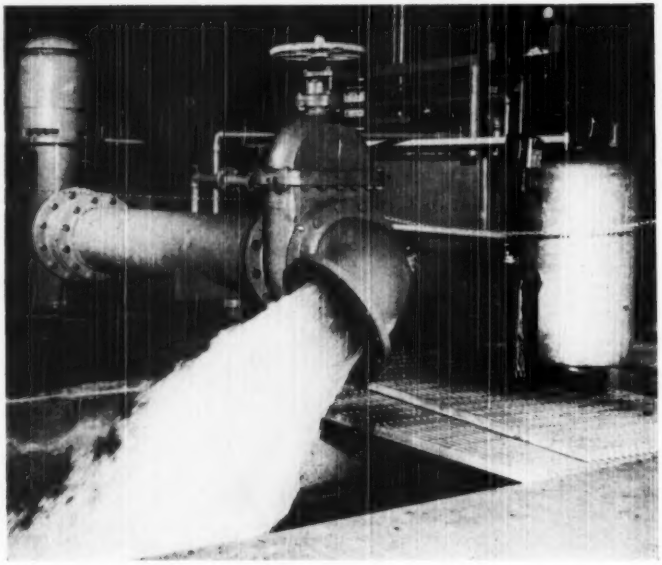
COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS



FIRE PUMP: An engineer takes gage readings on a 1000-gpm gasoline-driven fire pump, under test to meet Underwriters' rigid specifications for fire protection



TAPFUL TO TORRENT: On the right a small domestic water system is being tested; on the left a vertical-shaft flood-control drainage pump pours out a torrent

Test Tanks. The laboratory test tank has a capacity of over 500,000 gal of water, believed to be the largest in the United States. Pumps are tested to obtain complete performance data, observe their operation, and compare laboratory results with calculated performance data. This requires measuring the pump's capacity, head, power input and exact speed of operation. A pump laboratory requires a large water supply so accurate test readings can be obtained without entraining air in the water and without overheating recirculated water.

To provide water for testing several units at the same time and to have sufficient volume for large capacity pumps, the test pit is 30 ft wide by 192 ft long and 12 ft deep. At one end of this rectangular pit a round well 10 ft in diameter and 40 ft deep is used to test vertical pumps. A center dividing wall in the large rectangular pit permits draining one half for cleaning while the other half is in service. It also permits calibrating large meters by displacement. Based on 20% recirculation of water, the pit can test pumps up to 86,000 gpm.

Metering Equipment. There are several refinements in the hydraulic apparatus for greater accuracy in pump testing. Simplex venturi meters insure accurate capacity measurements to within 0.5%. Mercury manometers with scales calibrated directly in gpm for each size venturi tube guarantee maximum accuracy when measuring capacity and reduce to a minimum time required to make each test. Each discharge pipe assembly has a straight section of at least ten pipe diameters and more on the smaller sizes, installed between pump nozzzle and venturi meter. In addition, each discharge pipe contains straightening vanes three times pipe diameter in length and welded in the pipe 12 in. upstream from venturi meter.

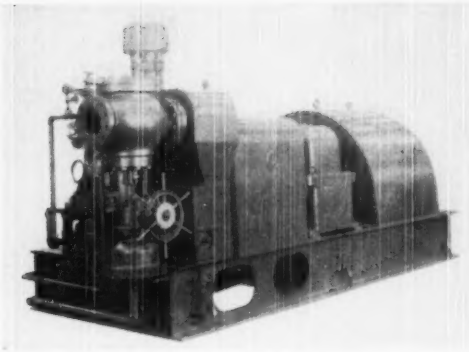
Heads up to 100 ft can be measured with a mercury column calibrated in feet of water. Beyond 100-ft head, calibrated Bourdon-tube gages give discharge pressure in psi. Mercury manometers on suction side of horizontal pumps give direct readings of suction lift.

Dynamometers. Featured in the new laboratory are accurate horizontal cradle-mounted General Electric dynamometers controlled by amplidynes with electronic preamplifiers. This installation is the first pump-testing laboratory in America to use this type of control. Wide selection is provided by 10-, 25-, 75-, 200- and 450-hp dynamometers for speeds up to 4500 rpm.

Power Equipment. Switchgear and motor-generators are in a separate fireproof, dustproof room. Motor-generators supply dc power to the dynamometers which are electronically regulated in combination with amplidynes to insure accurate speed control. With this equipment any desired speed can be set at the dynamometer control desk, and head, capacity, and horsepower readings at this speed obtained without further adjustments. Since speed is held constant by automatic devices, pump capacity is read directly in gpm. Head is shown in feet of water or is easily computed from pressure-gage readings, no other calculations being necessary. It is thus possible to observe immediately all operating characteristics of the pump under test and accurately record its data.

LETTERS FROM A TURBINE SPECIALIST—15

By C A LILLY, Jr and S N HEDMAN, *Turbine Divisions, General Electric Co*



GEARED TURBINE-GENERATOR SETS are usually provided for capacities ranging from 500 to 1500 kw for certain advantages

WHY BUILD GEARED TURBINE-GENERATORS?

Turbine Specialist
District Office

Dear Mr Specialist

The last time you were here you mentioned that turbine-generator sets rated from 500 to 1500 kw are of geared design, rather than direct connected.

There must be some good reasons for this practice. It seems that the gear unit between turbine and generator must increase your cost of manufacture. I suppose you have increased turbine speed and made some saving that way, but I would like to know what other changes have been made. Just how does the geared set compare with the direct-connected, and how does the customer benefit from this change?

Please let me have your answer as soon as possible. We will have our monthly engineering meeting in two weeks and I would like to report on the geared design.

Sincerely yours
ENGINEER

Dear Mr Engineer

Inherent flexibility of a geared turbine-generator set enables the designer to pick optimum turbine and generator speeds. Within limits, this provides a more compact and more efficient set for the customer. Let's look at the reasons.

For the best efficiency possible with available steam conditions a turbine needs a definite level of "Lambda." Turbine Lambda includes two components (1) revolutions per min (2) summation of wheel diameter in the rotating stages. (Lambda for single-row turbine stages is proportional to $N^2\Sigma D^2$. In this expression N = rpm and D = wheel pitch diameter.)

We have great flexibility in turbine speed used with a geared set, but are limited to a top speed of 3600 rpm in a direct-connected set for 60 cycles. By doubling the turbine speed to 7200 rpm in the above quantity, we would only need ¼ of the ΣD^2 needed for 3600 rpm. This means that with the geared design we can use smaller stages and fewer of them.

Theoretically a 2-row moving stage in a given turbine is equivalent to four single-row stages. It has been found, however, that this does not hold in practice. One 2-row stage is more nearly equivalent to three single-row stages.

This comparison shows how increasing the speed reduces the amount of turbine required. Saving in the amount of turbine with the geared design is greater in many cases than the cost of the gear needed.

In ratings through 1500 kw, the geared set will have lighter over-all weight, as well as take less mounting space. Installation expenses are lower with the more compact geared unit whose components are appreciably smaller and lighter in weight. Maintenance expense will also be lower because fewer turbine buckets, diaphragm nozzles, and interstage packings will be needed in the high-speed geared set.

Modern precision high-speed gears are extremely reliable. They have fewer parts needing maintenance than the additional larger stages necessary in a lower-speed turbine of direct-connected design. These precision gear units are quiet, having a noise level no higher than the other components of the turbine-generator set.

With this flexible design, the most efficient turbine speed can be used as well as the speed at which the simplest and lowest-price generator can be built. For geared sets, 1200-rpm generators are most commonly used, but where warranted, 1800- or 3600-rpm designs can be applied.

Where frequencies other than 60 cycles are needed, the optimum turbine and generator speeds can still be used because of the virtually unlimited number of gear ratios available.

All features such as speed and pressure governing, process control, extraction or mixed-pressure operation are available with the geared design. The designer has the flexibility of using the most advantageous speed for the particular conditions involved.

Today, it generally does not appear economically feasible to build geared sets above the 1500-kw ratings. At every rating and set of steam conditions there is a most economical speed at which to build the unit. This speed tends to be quite high at low ratings and decreases as the rating increases. With steam conditions most commonly used today the band of most economical speeds for ratings above 1500 kw is close enough to 3600 rpm to justify building direct-connected sets at these larger ratings.

The optimum speed increases as higher initial steam pressures are used. Therefore, in the future, it may prove desirable to build geared turbine-generator sets at even higher kw ratings.

I hope this short story has answered your questions on geared sets. I will be glad to discuss any specific application you have in mind during my next visit to your plant.

Sincerely yours
TURBINE SPECIALIST

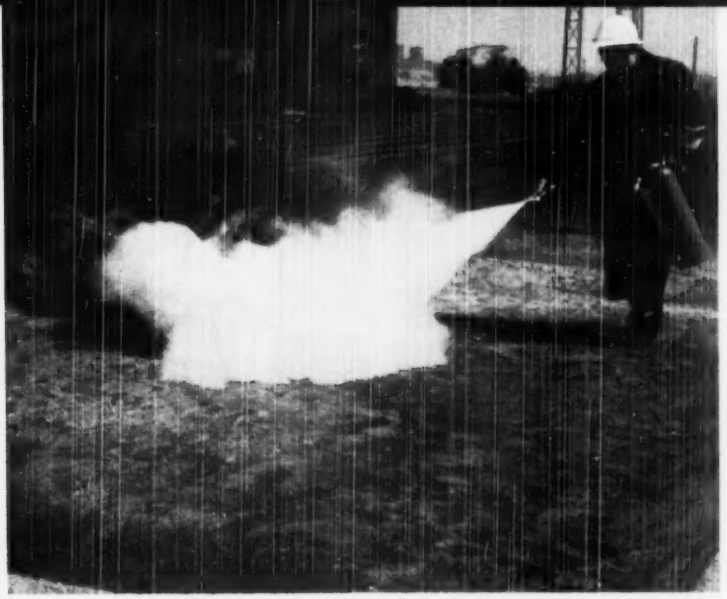
CARBON-DIOXIDE extinguisher in use on a switchboard fire. Note protective clothing includes gloves. This 20-lb unit is usually hung on wall close to possible fire areas. Large rolling-truck type CO_2 extinguishers are also suitable

WATER FOG in use on a live line, 117 kv to ground. In general, fog nozzles are safe to use at distances down to 6 ft on voltages to 120 kv to ground; water pressure 50 psi or more. Nozzle should be grounded (see panel on right of next page)

FIGHTING FIRE In Generating Stations

Here are the results of tests made at The Detroit Edison Co while setting up their fire-fighting program. Best uses for water spray, carbon dioxide and dry chemical are included

WATER FOG IS SAFE AROUND HIGH VOLTAGE



DRY-CHEMICAL extinguisher uses sodium bicarbonate. Well suited for fighting oil and gas fires. Much more effective than CO_2 for putting out all gasoline fires

By **JOSEPH J SHOEMAKER**, *Engineer*
The Detroit Edison Company

► GENERATING-PLANT FIRES stem from many sources. Some start during new construction, others while coal or other fuel is being handled. And the electrical fire hazard is always with us. But whatever the cause, the fact remains that men and proper equipment must be ready to handle each emergency. Let's take a few cases reported to us and consider the solutions.

Coal. There have been several fatal accidents resulting from flash fires by coal dust in suspension. For example, one fire occurred while a car of frozen coal was being unloaded in an industrial plant. Dust cloud was ignited by an oil torch and as a result a man died.

Another fire started in one of our bag filters connected to the coal-handling system. This filter removes coal dust from the hot air as it leaves the powdered-fuel mill. Apparently this fire started from spontaneous ignition of coal dust that had collected on the horizontal cross members in the bag-filter housing. Fortunately the fire progressed slowly since the bags had been treated, making them fire resistant.

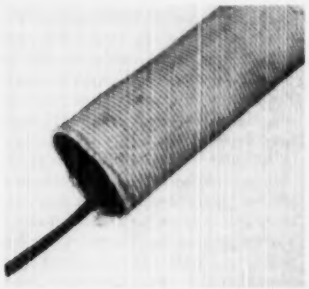
We found that steam, added above the bags, was ineffective in putting out the fire. And no safe means was provided for getting water into the bag-filter housing. It would be dangerous to open a door and use a water hose. This fire burned for some time and equipment damage piled up to about $7000. After this experience we eliminated all horizontal surfaces where coal dust might collect. Then an automatic water spray was added to each unit.

Now the bag filters are fitted with nozzles that will spray water inside and outside the bags along with flooding the housing with water fog. Each unit is served by a 3-in. pipeline and 120 spray nozzles, capable of delivering 260 gpm. If a fire starts in a bag filter, water is turned on by an automatic device that operates when the rate of temperature rise of the air leaving the bag filter is 60 deg per min or higher. As the water valve opens, an indicating lamp on the control board lights, showing which filter is in trouble.

A high-temperature alarm and an indicating thermometer are installed as a check on the rate of temperature-rise device. Since normal changes in temperature at all operating ranges are slow, they will not turn the water on. Each automatic device is checked every month by applying heat to the actuating bulb.

We installed this protective system about two years ago and find it quite satisfactory. We had considered wet-water for this application but, since the bags are slow burning, this wasn't necessary.

Transformers. One of our neighboring utilities recently had a transformer fire that resulted in a $60,000 loss. They



GROUND WIRE in hose equivalent to one No. 12 wire. Connects nozzle to ground

FOG NOZZLES break water stream into small particles making it essentially nonconductive. Nonadjustable nozzle and ground wire give good protection

invited several of our men to look over the unit while it was smoldering.

The fire had started at night during a heavy rain storm. One or more of the bushings on the 15,000-kva single-phase transformer flashed over. The differential relays failed to operate. Although the 140-kv and 40-kv switches opened, the 14-kv switches remained shut, leaving the 35,000-kva generator feeding into the fault.

Burning oil cascaded down the outside of transformer. This oil accumulated at the transformer base and developed into a large fire. Crushed-rock fill surrounded the transformer base; hence there was practically no fire on the ground. Oil was absorbed in the crushed rock and the fire extinguished about as fast as the burning oil ran into the ground. But the fire licking the lower radiator gaskets caused them to fail and thus contributed more oil to the fire.

How Handled. There were seven men on duty at the plant. After several minutes delay they used two 50-lb CO_2 cylinders. But the heat was so intense the operators couldn't get close enough to the fire. So the fire burned on. Next step was deenergizing part of the outdoor bus. Then one 2½-in. hose with a fog nozzle was brought into play. This was limited in effect since the men couldn't get at both sides of the transformer at the same time. The local fire department arrived and stretched out another 2½-in. hose with a solid stream. This combination put the fire out.

We did learn that the corrugated sheet-steel barriers prevented fire spreading to the transformers on either side. These barriers were somewhat warped before the fire was finally put out, but they were still intact. Had it not been for the barriers and rock-fill, all nine transformers in a row might have been lost. Heat developed was so great that the steel base of the transformer sagged to the point where the unit nearly turned over.

FIREFIGHTING

Basic requirements for firefighting equipment are simplicity, effectiveness and safety in use. Next question is where to use what extinguisher. Well, let's see where each of the popular extinguishers fits into our plant picture.

We find dry-chemical extinguishers most effective for gas, gasoline, oil and grease fires. The chemical used is sodium bicarbonate. Factory Mutual Laboratories tests show it is about three times as effective as CO_2 in putting out gasoline fires. Dry chemical is safe to use on electrical fires.

Water is still the best all-round means for fighting persistent fires. And water fog is very effective for oil fires. A 1½-in. hose and nozzle will handle rather large fires and still keep water damage down. Hose layout should provide for two or more 1½-in. fog nozzles to encircle, cool and smother the fire. This is often accomplished by a Siamese hose connection feeding the two 1½-in. lines from a 2½-in. feed.

Is Water Dangerous? Fighting fires around high-voltage electrical equipment has always been a problem. Water has been advocated for this job for many years now. But it has never been generally accepted by the men in the plant as a safe practice.

Ralph H Mertz and Charles E Quick of our company delved into the safety angle. Their studies showed grounded fog nozzles are safe to use at 6 ft or more from voltages of 120,000 v to ground or less, at water pressures of 50 psi or more.

Precautions. A nonadjustable fog nozzle is recommended for fighting high-voltage fires. For added safety, nozzle should be grounded. We found a flat copper braid, equivalent to one No. 12 copper wire, will do the trick. It should be imbedded in the fire hose and connected to the brass coupling at the hose end. It has proved the most effective way to ground hose nozzles.

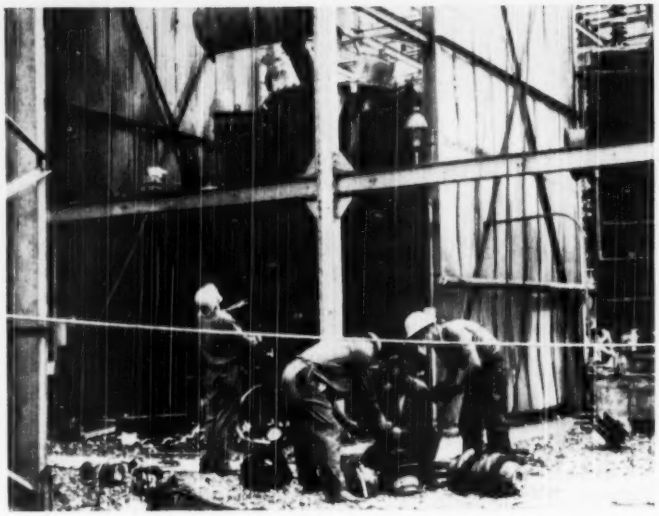
While a solid-stream nozzle is not recommended on high-voltage equipment, our tests show that even when used in error, results will not be disastrous provided the nozzle is grounded. In such a case the ground conductor will protect a man from injury on voltages up to 120 kv to ground with the nozzle not less than 6 ft from the live equipment. We strongly recommend using a nonadjustable fog nozzle at all times.

Fixed-spray systems that turn on automatically are well suited for protecting transformers and oil tanks. These firefighting systems are necessary since oil-filled transformers and oil circuit breakers are subject to fire and explosion. High-voltage stress, high-operating temperatures, lightning and switching surges may cause insulation failure. High-current arcs below the oil surface will rapidly develop a gas. This gas in turn may rupture the tank and possibly lead to igniting the oil. Although modern insulating oil has a high flash point it burns readily when ignited.

Hand Extinguishers. The CO_2 cartridge "tip-up" and hand-pump type extinguishers using city or river water were found safe at a distance of 2 ft or more from potentials of 8000 v or less to ground. Leakage currents at these limits were 1 milliampere or less.

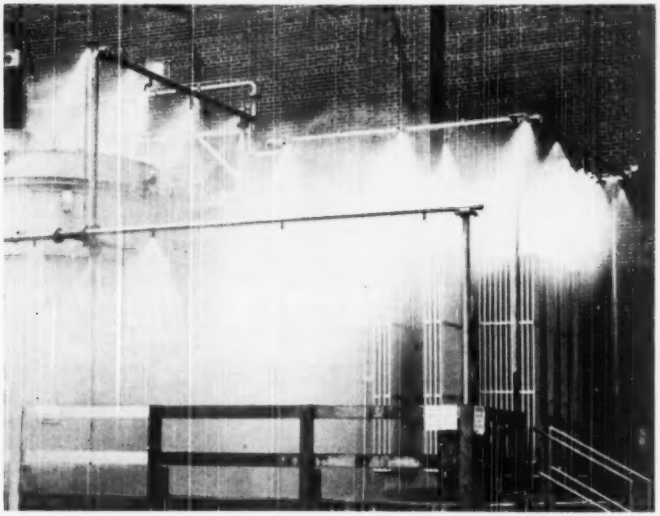
The above didn't hold true with soda-acid or the anti-freeze-solution type extinguisher. The solution in these extinguishers is highly conductive. We found it was not safe to use them near a 12-kv bus structure unless with a spray nozzle giving well-broken stream.

POWER TRANSFORMERS CAN BE FIRE PROTECTED BY A...



TRANSFORMER FIRE that started by flashover on high-voltage bushing, was kept fed by the transformer's insulating oil. Steel barriers kept the fire from spreading

...WATER-SPRAY SYSTEM THAT TURNS ON AUTOMATICALLY



AUTOMATIC WATER SPRAY is well suited for protecting transformers and oil tanks. System should include protection for steel that supports the overhead bus work

Our tests show the use of dry chemical in a dry atmosphere presents no hazard to the operator nor to the operation of the system. It does not seriously impare contact operation or rotating machinery. Dry chemical appears safe for fighting fires near live electrical equipment up to 120 kv. Even when insulators are wet there is little danger of flashover from use of this material in normal service.

FIRE PREVENTION

Here are some pointers to consider when plants are in the design stage. First off, there's the matter of equipment location. And this applies to spacing between oil-filled units, hazard to other equipment, and keeping away from walls with windows leading into buildings.

If possible, fire-protection features should be included in the original equipment design. For example, transformers should have inert gas above the oil. Oil level should be below the opening where bushings enter the tank. Where practical, all external oil connections should be welded to the tank.

Protect transformers and oil tanks with a water-spray deluge system. This should include protection for steel supports to overhead bus work and steel barriers between units. System should go into action automatically when fire starts. Don't support water lines from the framework of the equipment being protected. Also, consider using suitable fire-barriers between units to limit fire damage.

Provide some means to limit area exposed to oil spills; also, some means to carry oil or water away from the fire area quickly and safely. Remember, rock-filled areas call for periodic maintenance; otherwise they will fill up with dirt.

Make sure of an adequate water supply to handle large fires by ample leeway in design of mains, hydrants and pipelines. Keep hose lines as short as possible. Then provide auxiliary pumps to supply water to high-pressure standpipes for fighting high-elevation fires. Don't forget an adequate supply of hand fire extinguishers.

Alarm system should include a plant general-alarm system, a box from the City Fire Department alarm system and alarms on automatic fire-protection equipment. Also, include a signal that will go off if voltage fails on any of the automatic fire-protection equipment.

Design to protect against special fire hazards. For instance, use extra-heavy welded pipe and fittings on all turbine lube-oil lines. Then eliminate dust as far as practical in all steps of coal handling and preparation.

Inspection and Testing. Inspect all fire-protection equipment every two to four weeks. Flush out spray systems and test for automatic operation. Test hydrants and standpipes for water flow and pressure. Fire-prevention program should include testing dielectric strength of oil and insulation. Filter and dry the oil if necessary.

Training Men. Every man in the plant should be a potential firefighter. He should have actual experience in handling various types of extinguishers and actually putting out large fires. He should also know how to protect himself against intense heat and be confident in his ability to fight fires safely.

We've found the demonstration method, using good-sized fires, mighty effective and well received by the men. We even went as far as taking movies of fires being put out with various extinguishers. These have been used in our training program. The Detroit Fire Department has given us splendid cooperation.

The plant superintendent and the chief of the local fire department should look the station over and know where the main hazards are located, along with what fire-fighting equipment is provided. Together, they should plan the strategy of attack to handle any fires that may occur. Don't hesitate in calling the city fire department promptly when a fire starts. Make use of the experience, equipment and trained men the fire department has on hand.

CONGRESS PASSES OHM'S LAW!

According to Public Law 617, the 81st Congress recently enacted the following:

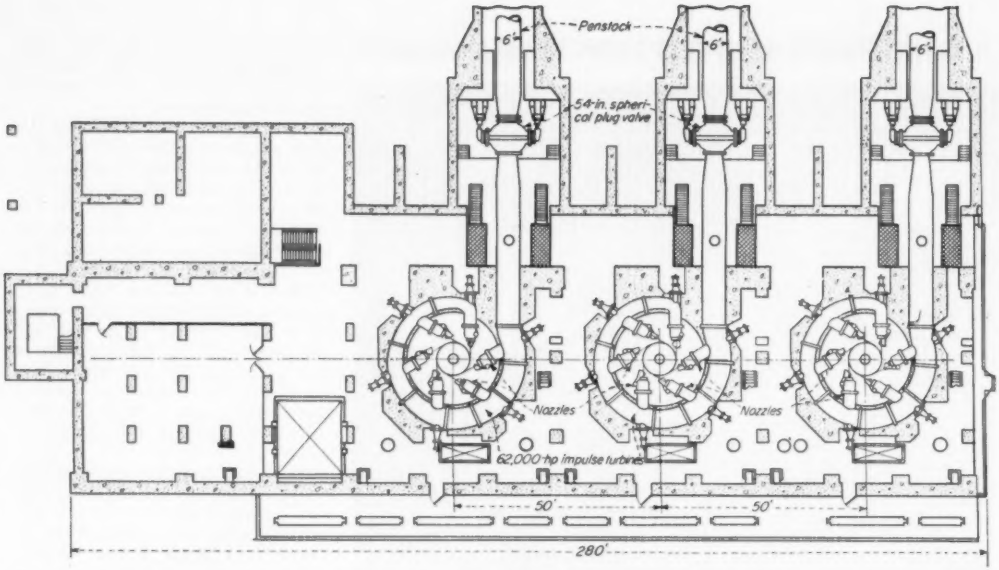
Sec 2. The unit of electrical resistance shall be the ohm, which is equal to one thousand million units of resistance of the centimeter-gram-second system of electromagnetic units.

Sec 3. The unit of electric current shall be the ampere, which is one tenth of the unit of current of the centimeter-gram-second system of electromagnetic units.

Sec 4. Unit of electromotive force and of electric potential shall be the volt, which is the electromotive force that, steadily applied to a conductor whose resistance is one ohm, will produce a current of one amp.

Sec 5. Unit of electric quantity shall be the coulomb, which is the quantity of electricity transferred by a current of one ampere in one sec . . .

. . . Sec 8. The unit of power shall be the watt, which is equal to ten million units of power in the centimeter-gram-second system and which is the power required to cause an unvarying current of one ampere to flow between points differing in potential by one volt.



1 Plan of powerhouse at turbine level shows three vertical-shaft 6-nozzle impulse turbines installed. Present program calls for ten 62,000-hp 300-rpm units operating under 1118-ft head, the largest turbines of their design in the world

Canada Installs World's Largest Multi-Nozzle Impulse Turbines

Highest-head hydroelectric development in Canada has three of ten 62,000-hp vertical-shaft impulse turbines installed. Each turbine has six nozzles operating under 1118-ft head. On field test, units indicated a maximum efficiency of 92%

By **T INGLEDOW**, *Vice-President and Chief Engineer*
J H STEEDE, *Executive Assistant to V-P and Chief Engr*
British Columbia Electric Company

► BRIDGE RIVER hydroelectric development is a relatively high-head project in Fraser River drainage area in Southern British Columbia. B. C. Electric Co is constructing it to serve Greater Vancouver and lower Fraser River Valley area. Project can be developed in progressive stages to capacity of about ¾-million horsepower. Three 62,000-hp units are in operation. Ultimately ten will be installed in a powerhouse on Lake Seton. A number of novel features make this project of interest.

Location. At the site of the project Bridge River, a tributary of the Fraser, is about 1400 ft above Seton Lake on opposite side of Mission Mountain. A 13,200-ft tunnel was driven through the mountain at elevation 1860 ft above Seton Lake. From the tunnel a steel penstock 2100 ft long for each unit runs to the powerhouse. On Bridge River a dam diverts water into the tunnel and maintains a head over its entrance. This tunnel will serve units No. 1 to 5. To complete the project will require driving a second tunnel to serve units No. 6 to 10.

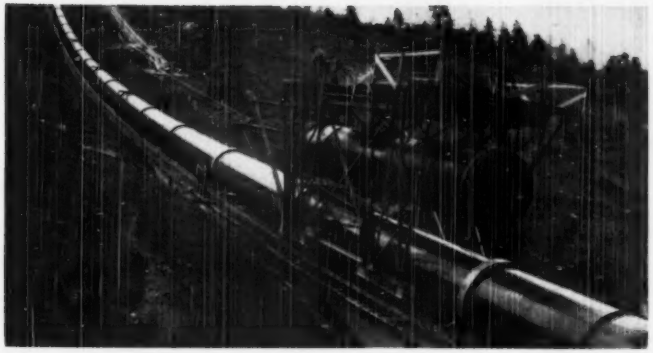
Penstocks are 75⅝-in. constant outside diameter and vary in thickness from ⅞ in. at top to 1 13/16 in. at bottom. A butterfly valve at top of each penstock closes automatically in a failure downstream. Closure is actuated by a differential-pressure device operated from a venturi section, below the valve.

Joints between penstock sections are made with Dresser couplings, to form an expansion joint every 40 ft. Designed for 1000-psi pressure these couplings remained tight when shop-tested to 1500 psi.

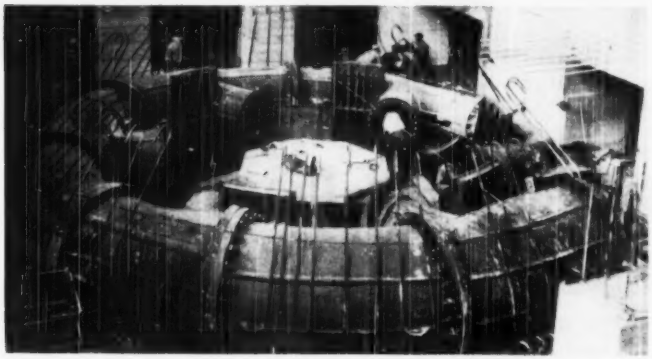
Erection of penstock sections, weighing up to 30 tons each on slopes up to 41 deg, was difficult. To solve the problem a gantry crane was installed to run on rails laid on top of the penstock footings and hauled uphill by an electric hoist, Fig. 2.

At the powerhouse each penstock connects to a 54-in. spherical plug valve, which can be closed to work on

Based on paper, *The Bridge River Hydroelectric Development*, at American Institute of Electrical Engineers, summer and Pacific general meeting, June 12-16, 1950, Pasadena, Calif.



2 Penstocks are 2100 ft long and 75 in. outside diameter. Sections weighing up to 30 tons were installed on a steep mountainside with this traveling gantry



3 Six turbine nozzles, each 10½ in. diameter, connect to 8-section cast-steel spiral casing. No. 1 section's inlet diameter is 66 in. and weighs 12 tons

the turbine without draining the penstock. Each valve, weighing about 37 tons, has a joint that can move endwise about 4 in., to permit uncoupling for removal.

Impulse Turbines. Vertical-shaft impulse turbines have six nozzles, are rated 62,000 hp at 300 rpm under 1118-ft head. Each 6-nozzle spiral casing, Fig. 1 and 3, is made of eight steel castings. Largest casing section weighs nearly 12 tons, has 66-in. inlet diameter. Each nozzle's diameter is 10½ in.

On each turbine runner, 20 buckets 26 in. wide are bolted to a solid steel disk, 6 in. thick, that connects to the generator by a 24-in. shaft.

A Woodward governor controls each turbine's speed. Governor through a servomotor and rocker arm actuates a hydraulic-piston-type jet controller on each nozzle. Jet deflectors operate automatically if load drops suddenly.

These units are believed to be largest vertical impulse turbines ever built. Except for certain parts Vancouver Engineering Works built them to designs by Pelton Water Wheel Co. They represent an advance in impulse turbine design and operating efficiency. Gibson tests on No. 2 unit indicate efficiency of 92% at 60% load and efficiencies in excess of 90% from 33 to 93% rated output.

Main Generators. These units, rated 50,000 kva, 0.90 pf, 13,800 v, are of conventional design. Weight of generator rotor and turbine runner is taken by a Kingsbury thrust bearing with upper and lower guide bearings. They are totally enclosed with eight water coolers mounted on the rim of the stator to absorb generator heat losses from circulating air. Water sprays controlled by a hand-operated valve provide fire protection in generator windings. Main exciter, pilot exciter and governor permanent-magnet generator are supported on upper bracket, connect to generator shaft.

Generator Efficiency. Because of its comparatively high speed and small number of poles each generator occupies only 20 ft square, but is 23 ft high overall above stator's foundation. For the same reasons, efficiency is quite high. Manufacturer's guarantees are 97.8% at full load, 97.3 at ¾ load, and 96.46 at ½ load, all at 0.90 pf lagging.

Generator Rotor. The 24-pole rotors, 155½-in. in diameter, have pole-pieces dovetailed into slots in a laminated rim shrunk on a cast-steel spider. This structure is designed for twice normal speed, or 600 rpm.

Bearings are watercooled, have temperature detectors that sound an alarm before a bearing overheats.

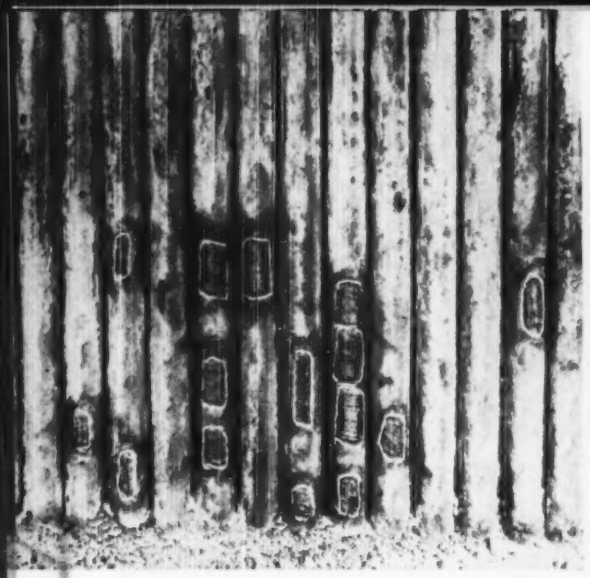
Hydraulic brakes under the rotor are designed to bring it to rest in 15 min after water has been shut off from turbine. Normally each turbine is stopped by a water jet on the back of its buckets. The hydraulic brakes can also be used as jacks to lift rotor off the thrust bearing for adjustment or maintenance of this bearing.

Main Transformers. These are 3-phase, rated 50,000 kva, 13.8 kv delta on the primary and 230-kv wye secondary with the high-voltage neutral solidly grounded. Two external forced-oil, watercooled heat exchangers per unit cool transformer oil. Each cooler can take care of a transformer operating at 75% load. Heat exchangers are below the transformers, and oil pressure within them is higher than water pressure. Then if a leak develops in the water piping, oil leaks into the water—not water into the oil.

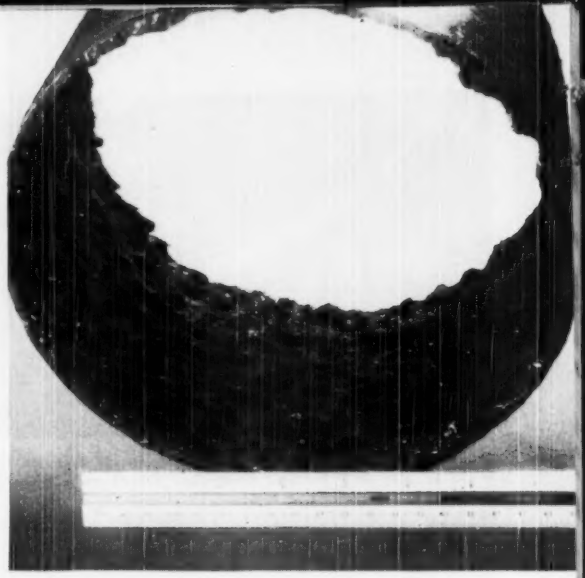
Station-Service Supply. An oil circuit breaker and service transformer connects to the low-voltage side of each main transformer. Switchgear is metal-clad and its oil circuit breaker is rated 15-kv 3000-amp 1,000,000-kva rupturing capacity. The 3-phase 300-kva service transformers have load-ratio control on the primary and stepdown to 460 v on the secondary for normal auxiliary-power supply.

A 4000-kva 2300-v hydro plant, installed some years ago near the new plant's site for construction power and local service, provides a separate station-service supply. This supply, stepped down through 2300- to 460-v transformers, can be synchronized on the station-service bus. The arrangement permits supplying station and auxiliaries from any main generator or from the separate station-service supply.

On its high-voltage side each main transformer connects through a motor-operated disconnect switch and four oil circuit breakers to a 230-kv ring bus. Present plans call for four 230-kv transmission lines when all ten units are installed. At that time two generators through their transformers will connect to each of five positions in the ring.



1 Flame corrosion caused metal loss from waterwall tubes. Welded reinforcements replace metal, prevent more losses



2 Honeycomb corrosion can weaken metal of tubes and shells. Corrosion in small areas reduces metal thickness quickly

How Boiler Steel Can Disappear

Have you ever seen or heard of a boiler drum or tube becoming too thin to operate safely? The answer should be yes. Where, then, does the metal go, and why? Here are the right answers

By **HARRY M SPRING**, *Professional Engineer*

► METAL IS REMOVED BY (1) internal wasting and (2) external wasting. The action may be either corrosion or erosion. Corrosion, briefly, is electro-chemical in nature while erosion is mechanical abrasion. Let's take a closer look at each.

Internal Wasting. Attacks on internal surfaces of a boiler are like the operation of a storage battery. One portion is electrically positive (anodic) while another is electrically negative (cathodic). If the two portions are in contact with a liquid solution, the electrolyte, current may flow from plus to minus, Fig. 5. During flow of current tiny particles of metal go into solution.

Flow of one-millionth of an ampere dissolves about 39 lb of steel a year. Current flow may easily exceed this value if concentration of solids is favorable. Areas affected may be large—in these cases reduction of thickness will be small. Or they may be concentrated in cells, grooves or pits. Fig. 2 shows many pits, so closely spaced metal is weakened. It is "honeycomb" corrosion.

Highly stressed areas are more easily attacked. That's why grooving occurs at such points, Fig. 6.

This theory of electrochemical action as the cause of internal corrosion is now widely accepted. Do not confuse it with electrolysis or stray-current galvanic action. Electrolysis is an exaggerated form of electrochemical corrosion between dissimilar metals. Galvanic action is leakage of stray direct current through boiler and piping to ground. Effects of both are usually localized.

Remedy for internal corrosion is to make the solution a "poor electrolyte" or current carrier and remove from it all accelerators like oxygen and carbon dioxide. "Conductivity" is cared for by keeping boiler water well out of acid range by treatment. Oxygen and carbon dioxide are controlled by heating feedwater to near or above boiling point and treating with sodium sulfite.

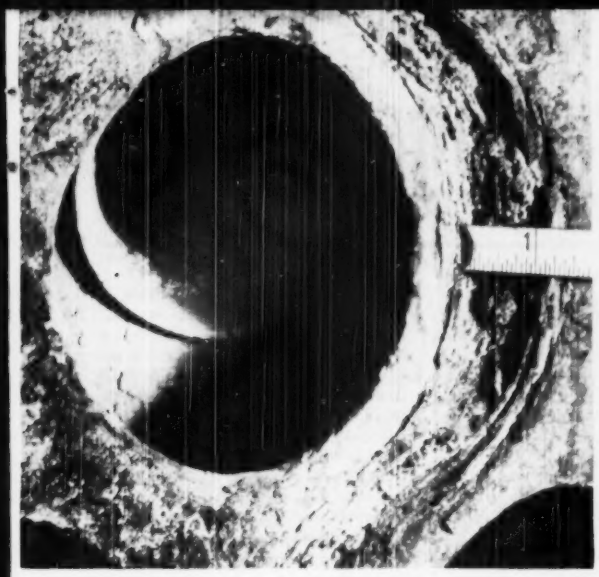
Protective coatings on internal surfaces provide insulation, and have been used successfully. Causes of mechanical removal of steel that should be self-evident are chafing of baffles and careless use of a tube turbine.

External Wasting. Here we consider the action as chemical wasting or an erosive attack. Chemical wasting may be caused by moisture and acid or by certain high-temperature gases.

Exposure to moisture of boiler steel coated with soot, coal or ash containing sulfur causes chemical wasting. Acid formed by sulfur and water is the agent. Fig. 4 shows boiler tubes that were buried in soot. Moisture came from sweating of the boiler during idle periods in humid weather.

Leakage from manhole or handhole gaskets is another source of moisture. Sinuous headers, Fig. 3, may become dangerously thin before the condition is discovered. Incrustations at manhole or handhole gaskets may indicate corrosive wasting. Full investigation should be made to reveal and halt its progress.

During recent years, sulfur trioxide has been found a factor in what might be called "flame corrosion" of tubes exposed to furnace temperatures, especially when firing pulverized coal. Fig. 1 shows welding reinforcement necessitated by this wasting. Better distribution of secondary air appears the answer. The blanket of air in the areas



3 Sinuous headers may become dangerously thin when water from handhole gaskets combines with sulfur to form acid

4 Boiler tubes buried in soot often lose metal when atmospheric moisture forms acid by combining with sulfur in soot

that are susceptible checks corrosion.

Flame scrubbing or impingement by abrasives in gas, Fig. 7 and 8, is a frequent cause for loss of metal. Recirculation of soot increases abrasives in gases. Savings are questionable when weighed against loss of metal.

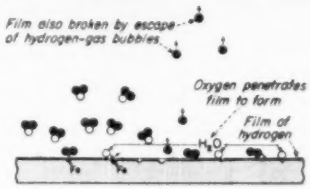
Fuel and air adjustments should be controlled to avoid flame scrubbing. Not only do solid particles wear the metal but overheating may also result. Soot-blower elements are bad offenders if warped or out of alignment. Rapid wearing of tubes to point of failure occurs too often.

In recent years boilers have been operated with high-velocity gas flow. Eddy currents set up by U-bolts on tubes have caused tube failures. Streamlining bolt bodies is the cure. Gas leakage through cracks in baffles causes similar damage. Difference in gas pressure in passes sets up high-velocity jets of abrasive-bearing gas through cracks.

A slight gap between a steam drum and the top of a gas baffle in a 400-psi boiler caused a groove over ¼ in. deep and 12 ft long. You can easily imagine what might have happened to this boiler if the condition had not been discovered and corrected.

Best remedies for preventing disappearance of boiler steel are inspection and maintenance. Have your boilers inspected regularly by a thorough inspector. Follow his recommendations and don't put them off until next week. Between his visits keep a careful watch on your boilers to see that internal and external wasting are not stealing your plant from you.

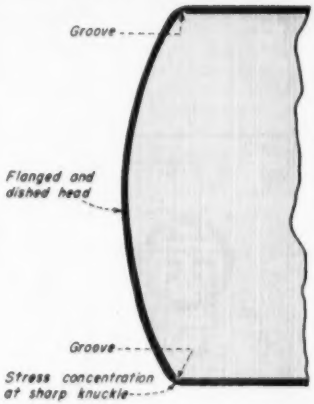
BOILER STEEL DISAPPEARING? THESE SKETCHES SHOW WHY



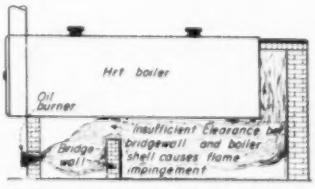
BASIC ACTION OF CORROSION:
1 Ions of iron go into solution
2 Electrical balance is maintained by plating out of equal number of hydrogen ions
3 Protective hydrogen film is broken by uniting with free oxygen or by escape as gas bubbles
4 As film is broken, cycle repeats

LEGEND
H_2O (water) — Hydrogen
Oxygen — Iron ions

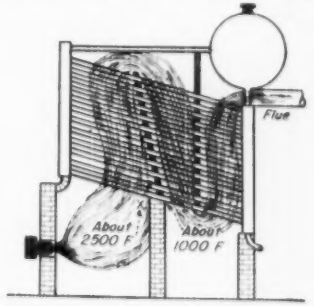
5 This is how internal wasting can remove metal from your boiler surfaces



6 Grooving in highly stressed areas is frequent example of internal wasting


Hrt boiler
Oil burner
Insufficient clearance between bridgewall and boiler shell causes flame impingement
Bridge wall

7 Flame scrubbing or impingement in hrt is a common form of external wasting

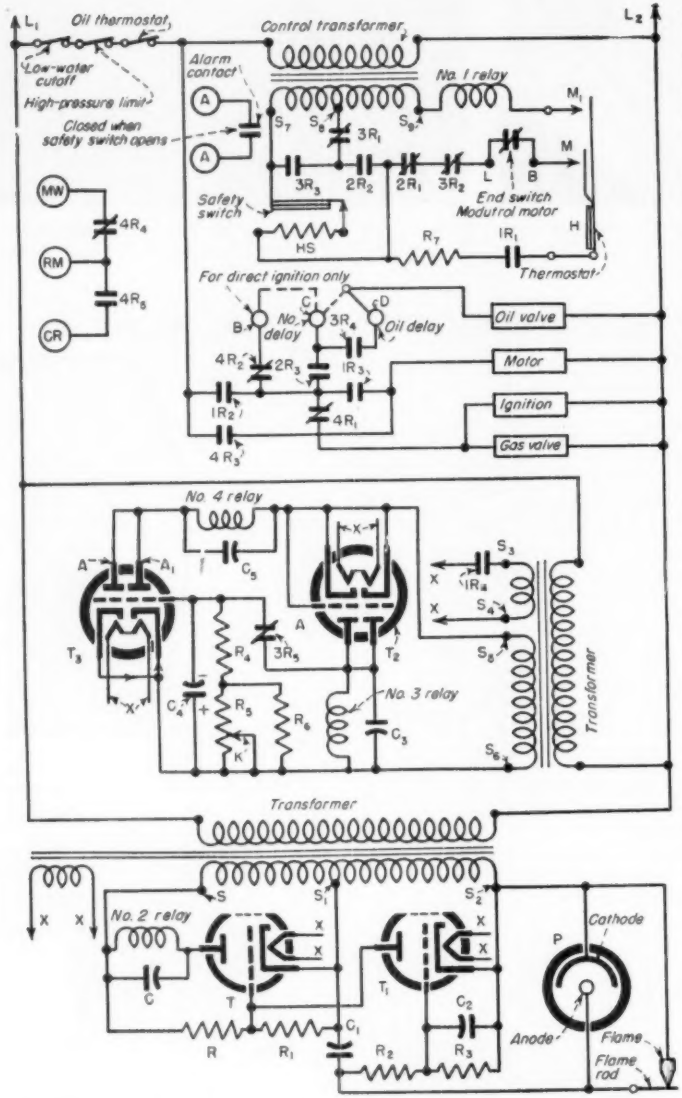


8 Flame scrubbing in watertube boiler causes loss of metal and overheating

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

30 — Combustion Safeguards: III



FLAME-FAILURE EQUIPMENT with electrode in the pilot flame and phototube to scan the main flame. System protects against almost every hazardous combustion condition

► IN THIS, the third and last article on flame-failure protective devices, we study a system where flame rectification is used as a means of sensing the flame. A flame rod shows that the pilot flame has ignited and a phototube scans the main flame. System contains about everything you could expect to find in flame-failure protective equipment. So it makes an interesting study from electronic as well as from control aspects.

Flame Rectification. The diagram shows a flame-failure protection equipment (Minneapolis-Honeywell) that uses a flame rod during starting of the fire, after which a phototube scans the main flame. Flame rod and pilot burner are designed for what is called flame rectification. Systems previously described, which used a flame electrode, were actuated by flame conductivity. In these, operation depends on the flame's ability to conduct current.

Flame rectification is based on the flame conducting more current in one direction than in the other. For flame rectification the burner is designed so its area in contact with the flame is at least four times the area of the rod extending into it.

The larger the burner area in contact with the flame compared to the electrode, the greater the current from flame to electrode. Under these conditions the burner has minus polarity, and the electrode plus. When circuit polarity reverses only an extremely small current flows from electrode to flame.

In the diagram, when light from the flame reaches the cathode of phototube P, current can flow from cathode to anode when the former has minus polarity and the latter is plus. Under the same conditions current flows from flame to flame rod.

No-Flame Conditions. Assume no-flame conditions. Then circuits through phototube P and the flame rod are open. When S_2 is minus, grid of tube T_1 is given a plus bias from cathode to grid, the resistor R_2, *capacitor* C_1 to S_1. So tube T_1 conducts through R to S and R_1 to S_1. Tube T grid is given a minus bias equal to volts' drop across R_1; this tube cannot conduct, so No. 2 relay remains inactive.

Contacts for this relay are in upper part of diagram, marked $2R_1$, $2R_2$ and $2R_3$. There is also a circuit from S_2 through R_3, R_2, capacitor C_1 to S_1. For

all practical purposes this circuit may be considered open because of the high resistance of R_2 and R_3, about 20 megohms each.

Burner Is Lighted. Assume that burner is lighted and S_2 terminal is minus. A voltage is now applied from S_2 through phototube and flame rod, capacitor C_1 to S_1 and through R_1 and R to S. There is also a circuit through R_3 and R_2 to C_1, which is charged with its bottom terminal minus. When transformer polarity reverses, phototube and flame rod are practically nonconductive. A voltage is applied from S through resistors R, R_1, capacitor C_1, resistors R_2 and R_3 to S_2. This puts voltage of the transformer in series with that of C_1 to cause current to flow in the circuit.

Voltage drop across R_3 is applied to capacitor C_2 to make its lefthand terminal minus. Voltage drop across R_3 is also applied from the grid to cathode of tube T_1 to give it a minus bias. When transformer polarity again reverses and S_2 is minus, capacitor C_2 tends to discharge from the grid to cathode of T_1 and block this tube. This removes the minus bias from tube T_1 and it conducts to close relay No. 2. Phototube P and the flame rod conduct through a circuit as before to charge capacitor C_1, which when polarity again reverses, charges C_2 to hold minus bias on the grid of T_1.

There are other circuits on this diagram that can be explored. But the ones considered show how during no flame, tube T_1 conducts and blocks tube T to cause No. 2 relay to open. Also how, when there is a flame, tube T_1 is blocked and T conducts to close relay No. 2.

Timing Relays. Relays No. 3 and No. 4 have a time delay in their operation. Cathode heaters in tubes T_2 and T_3 of the relays are not energized until contact $1R_4$ of relay No. 1 closes in transformer secondary S_3S_4. Fifteen seconds after relay No. 1 closes, the cathode heaters of tube T_2 reach operating temperature. This tube can then conduct from S_3 through the tube, No. 3 relay coil to S_4.

Voltage drop across this relay coil is applied from anodes of T_2 through capacitor C_4 to S_4 to charge it to the polarity shown. This voltage is also applied from the grid to cathode of tube T_3 to give it a minus bias. When relay No. 3 closes, it opens contact $3R_5$ to break charging circuit for capacitor C_4.

When transformer terminal S_3 becomes minus, current tends to flow through tube T_3, No. 4 relay coil to S_4. But capacitor C_4 tends to discharge from tube T_3 grid to its cathodes, holding the grid minus to block this tube. C_4 discharges through R_4, R_5 and R_6 at a rate depending on the setting of contact K on resistor R_5. Positioning this contact can vary the delay of No. 4 relay so it will close from 1 to 60 sec after contact $3R_5$ opens.

Oil-Burner Control. Now that we know how the flame-failure and timing relays operate we will study lighting off the gas pilot and the oil burner in the boiler furnace. In series with the control transformer are the contacts of the low-water cutout, high-pressure limit and oil thermostat. Assume these closed and the system ready for operation.

When thermostat H closes its contacts M and M_1 for more heat, relay No. 1 is energized from, say, S_1 on the transformer through the safety-switch contact and heater, relay contacts $2R_1$ and $3R_1$, end switch on the Modutrol motor, thermostat contacts M and M_1, No. 1 relay coil to S_2 on the transformer. Note that end switch on the motor must be closed before No. 1 relay can be energized and the fire lighted. No. 1 relay closes contacts $1R_1$, $1R_2$, $1R_3$ and $1R_4$. Contact $1R_1$ completes a holding circuit around the end switch on the Modutrol motor so this switch can open and relay No. 1 remain closed.

Connections B, C and D permit opening the oil valve simultaneously with the gas valve and energizing the ignition or delaying opening of the oil valve until No. 3 relay has been energized. We will assume oil-valve-opening delay and connect this valve to D as indicated by the full line.

No. 1 relay contact's closing completes the power circuit for the gas pilot-valve coil, ignition coil and burner motor. Circuit for the first two is from line L_1 through contacts $1R_2$ and $4R_1$, the ignition and gas-valve coils to line L_2. Contacts $1R_3$ and $1R_4$ complete the burner motor circuit and this motor starts. Oil valve remains closed because its circuit is open through contacts $2R_3$ and $3R_1$. Contact $1R_4$ closes the cathode-heater circuits of timing vacuum tubes T_2 and T_3, to start the timing cycle.

As soon as contact $1R_2$ closes, the pilot gas valve opens and ignition is applied. Immediately the pilot flame is sensed by the flame rod and No. 2 relay is energized by the flame rectification circuit as previously explained.

Electronic-Flame Relay. No. 2 relay closes contacts $2R_2$ and $2R_3$ and opens contact $2R_1$. Closing contact $2R_2$ shunts the safety switch and its heater HS. A circuit for No. 1 relay coil is from tap S_1 on the transformer, contacts $3R_1$ and $2R_2$, resistor R_1, contact $1R_1$ to the relay coil. Contact $2R_1$ opens the circuit through the end switch on the Modutrol motor, so this switch is no longer effective in the control circuit. Contact $2R_3$ closes in the oil-valve circuit, which is still open through contact $3R_2$, and this valve cannot open.

Timing Relays in Control Operation. Fifteen seconds after $1R_4$ closes, cathode heaters of time-delay tube T_3 reach operating temperature and coil of relay No. 3 is energized, as previously explained. Contact $3R_1$ opens and $3R_2$ closes to shunt the safety switch and its heater from S_1 through $3R_2$, $2R_2$, resistor R_1, contact $1R_1$, relay coil to S_2. Safety switch is no longer effective in No. 1 relay-coil circuit and, being shunted, its heater cools to room temperature.

When contact $3R_2$ closes, it completes a circuit through the oil valve coil, contacts $1R_3$ and $2R_3$ having been closed previously. As soon as $3R_2$ closes, the oil valve opens and the main flame should start since the pilot flame has been proved satisfactory by No. 2 relay closing.

Contact $3R_3$ opens the blocking circuit of timing relay tube T_3. From 1 to 60 sec after this contact opens, depending on the setting of contact K on variable resistor R_5, tube T_3 conducts and closes relay No. 4, as we learned earlier. This relay closes contact $4R_3$ to provide an alternate circuit around $1R_2$ contact to the burner motor to insure motor overrun on normal shutdown. When contact $4R_1$ opens it disconnects the ignition and gas valve coils.

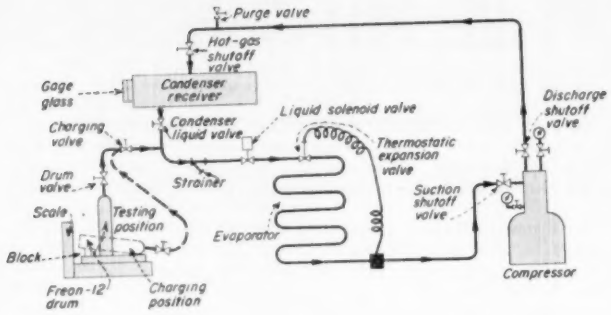
Responsibility for flame check is transferred automatically from flame rod to phototube that scans the main flame. At the same time, contact $4R_2$ opens and removes the RM short on the Modutrol motor which had previously been held in low-fire position. Closing of contact $4R_3$ completes the circuit that returns the motor to the modulating controller. Burner is now in normal operation.

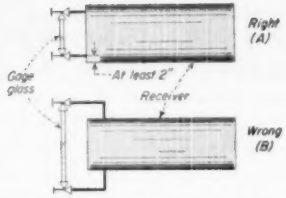
Heat Demand Satisfied. When heat demand has been satisfied, thermostat opens contacts M and M_1 and relay No. 1 drops out. Opening relay contact $1R_2$ closes the oil valve, and contact $1R_4$ breaks the circuit to the cathode heaters of time-delay tubes T_2 and T_3. The ignition and gas-pilot flame cannot come on because they are powered through contact $1R_2$ and $4R_1$ which are open.

As the flame dies out, phototube P becomes inoperative and relay No. 2 drops out as it should under no-flame conditions. When the cathode heaters of tubes T_2 and T_3 cool, (about 15 sec after No. 1 relay opens) relays No. 3 and 4 drop out. When contact $1R_4$ opened it cut off the burner motor. Contact $4R_1$ closes and $4R_2$ opens to return the modulating valve to low-fire position to complete the start circuit for relay No. 1. End switch LB must be closed in low-fire position before the circuit for this relay is complete and a new firing cycle can start.

Flame Failure. Failure of the pilot

(*Continued on page 154*)





GAGE-GLASS installation on a horizontal receiver. Always use the method at *A*

FREON-12 SYSTEM is tested for leaks with drum in vertical position. Drum is tilted with valve-end low to charge system

How Would You Answer These?

Here are 9 chances for you to make a quick check of your refrigeration know-how. See how many of these license questions you can answer without help

1 What are best pipe joints for an ammonia system?

Welded joints are best but screwed joints may be used if pipe is made up with a sealing compound.

2 How can you tell there's enough ammonia in a system without a gage glass?

When suction line is frosted to compressor cylinder you can be sure enough liquid is reaching evaporator. Of course receiver should be partly full so system has reserve capacity when needed.

3 Sketch and describe proper method of charging a new Freon system for air-conditioning work.

Place Freon drum on scale, sketch at left. Connect to charging valve with flexible copper tubing or metallic hose. Crack drum valve to check connections for leaks. They bubble when connections are coated with soap-and-water solution. Open compressor suction and discharge valves, condenser hot-gas and liquid valves and liquid solenoid valve. Then open charging valve and crack drum valve to raise pressure to 40 psi.

Now test every joint in system for leaks. Use exploring tube of a halide torch on all pipe joints, especially around compressor. Slightest trace of Freon-12 turns torch flame from blue to a green color. Repair leaks and recheck with torch to make sure entire system is tight.

With system tight, put a load on evaporator. In air-conditioning systems air can be blown over coils. Close condenser liquid valve and note drum weight. Lay drum on scale and open charging and drum valves. Circulate water through condenser and run compressor intermittently until system is charged. Freon should show in bottom of condenser gage glass. Close charging valve and open condenser liquid valve.

4 What happens when refrigerant passes through the expansion valve?

It expands because it goes from a higher to a lower pressure. As pressure drops, boiling temperature decreases and some of the refrigerant vaporizes.

5 What safety items are needed in ammonia plants?

Gas masks, fire extinguishers, charging hose, emergency lights, pipe clamps, leather gloves and a first-aid kit should be ready at all times. At least two approved gas masks with built-in goggles are needed. Fire extinguishers should be suitable for electrical fires. Flexible charging hose is safer than steel pipe. Lanterns or open lights are hazardous. Use flashlights, keeping them near the masks. Pipe clamps, ¼- to 2-in. sizes, are handy for sealing small leaks in liquid and gas lines.

6 How would you connect gage glass to receiver?

Connect to receiver head. *A* in upper-right sketch. Keep bottom connection at least 2 in. above shell. Connections like those in *B* are unsafe because oil and scale accumulate in bottom line, giving false level. Also, ballcheck in bottom cock won't work when glass blows out if line is plugged.

7 What causes refrigerant condenser to lose capacity?

Condenser loses capacity when cooling-water quantity is low, when air and gases are trapped in condenser, when tubes are coated with oil, and when cooling-water inlet temperature is high. Sudden loss of capacity results from stoppage of cooling water.

8 How do you defrost direct-expansion evaporator coils with hot gas?

Use hot gas from discharge side of compressor for best results. Pipe gas to top of evaporator coils. Run the compressor slowly to force hot gas into the coil. Time needed for defrosting depends on amount of ice on coils, refrigerant and coil temperatures.

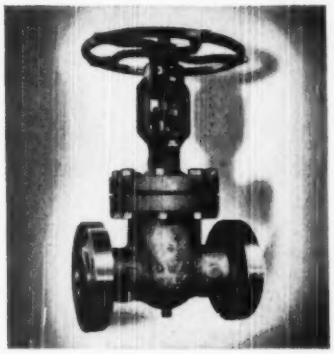
9 What is liquid slopover and how can you prevent it?

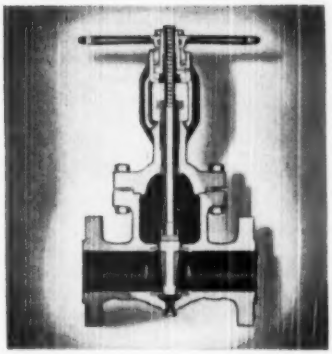
Slopover is the passage of liquid refrigerant from evaporator coils to compressor suction. Liquid enters compressor in slugs, breaking down cylinder lubricant. Scored cylinders and excessive wear result. Also, since liquid is cold when it enters cylinder it causes rapid contraction of the wall. Cylinder wear is increased.

Easiest way to stop liquid slopover is use of a suction trap and liquid pump. Trap removes any liquid before it enters suction line and pump returns it to receiver.

WANTED

INFORMATION AS TO THE WHEREABOUTS OF ONE EDWARD GATE VALVE WHICH ISN'T PERFORMING SATISFACTORILY!





DESCRIPTION: Close fitting wedge guides prevent wear-producing wedge drag on seating faces—accurately located with respect to seating faces and wedge, then welded integral to the body while master wedge is still in place • Looseness eliminated and wear reduced to a minimum • One-piece bonnet aligns stem accurately • Needless weight and unnecessary working parts eliminated • Two tight seating faces • Ball bearing yoke makes operation easy • Uniform metal sections reduce distortion in heating and cooling • Integral but replaceable hard surfaced seats greatly lengthen valve life.

The Edward Gate Valve Apparently Has a Perfect Record—We Have Literally No Information on Service Complaints!

Since the Edward Gate Valve was introduced, not one valve deficiency has been recorded. Our men are still on the lookout for information concerning the whereabouts of an Edward Gate Valve in need of service. If you know of, or can find, any Edward Gate Valve requiring attention, please contact your Edward Valve representative, or get in touch with our main office. Your help will be greatly appreciated.

Another Product

Edward Valves, Inc.

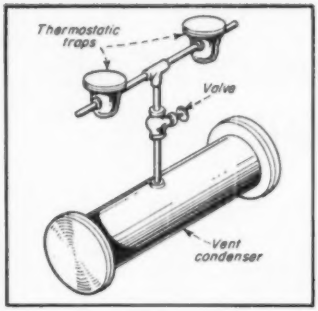
Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

TRAPS CUT DOWN DEAERATOR STEAM-VENTING LOSSES



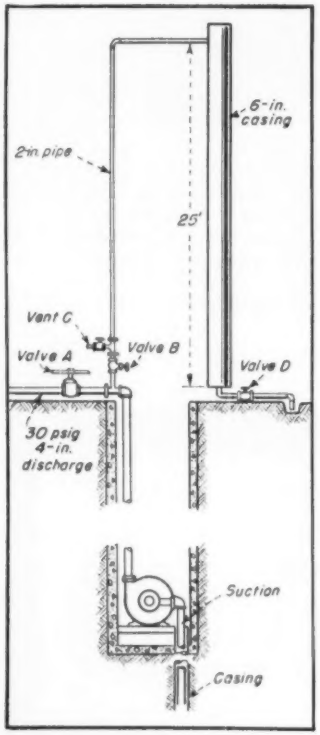
MOST STEAM-POWER STATIONS vent the noncondensable gases from their deaerating heaters through a manually controlled globe valve. To insure complete venting at all pressures in the heater, the valve is usually opened to the point where considerable steam may be vented to atmosphere at times of heavy load.

We found that this can be prevented by installing a trap in the vent line. We installed two traps on this line from our deaerating heater as shown in the sketch. They are bellows type, actuated by temperature of the fluid flowing through them. Steam discharge is almost nil. We followed our oxygen-removal performance very carefully, by testing for excess sulfite in the boiler water. No change in this factor indicated that all the oxygen is being removed, as with direct heater venting before installation of the traps.

Two traps were hooked up so when one fails, or is off for repair, the other is on duty. Two traps also permit faster venting if a slug of air should enter the deaerating heater during startup or for any reason.

K M WHITE *Clinton, Iowa*

STANDPIPE CREATES VACUUM FOR QUICK PUMP PRIMING



WE HAD A 300-GPM centrifugal pump in a 35-ft concrete pit taking water from a drilled well. Suction line was welded solidly into the pump inlet. As time went on the ground-water level fell till it was about 6 ft below the pump center line. Finally the pump could not prime itself any more.

We rigged up a vacuum pump on the discharge line to draw water into the pump for priming. This worked fairly well, but we permanently cured the trouble by the priming arrangement shown in the sketch. We made a standpipe out of 25 ft of 6-in. casing by welding shut both openings and providing connections as shown in sketch at left.

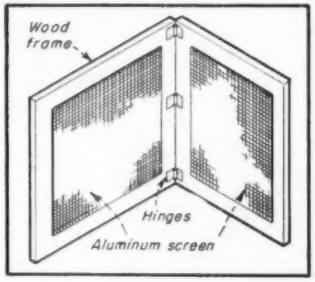
The standpipe is normally kept full of water. To prime the pump, close discharge valve *A* and vent valve *C*, open valves *B* and *D*. Water draining out of *D* forms a vacuum in the top of the standpipe. This draws air out of the pump and its piping, causing water to rise into the pump suction. The pump can then be started. Valve A is slowly opened and *D* closed. When the standpipe is filled valve *B* is closed and the system is ready for the next priming operation. Large standpipe outlet speeds priming operation.

E A ROBERTS *Carlsbad, N. M.*

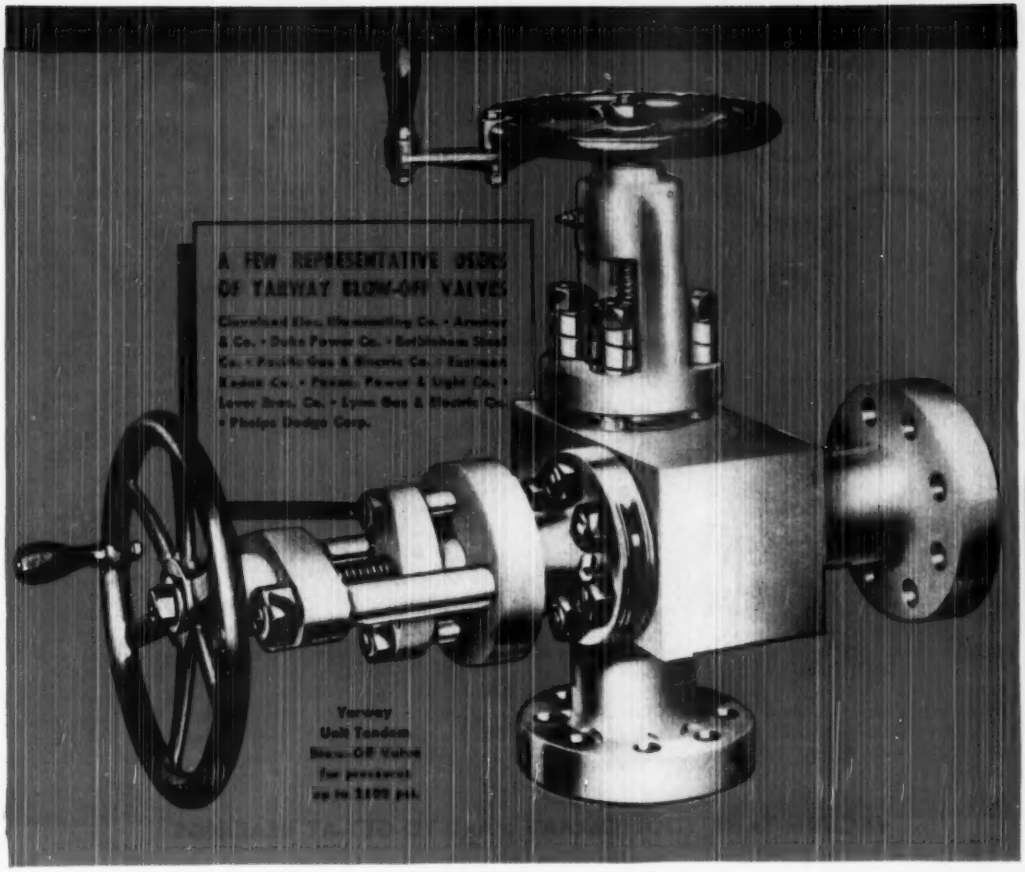
ALUMINUM SCREEN GIVES HEAT RELIEF

WE FOUND IT uncomfortable to work in the vicinity of several hot-oil pumps with temperatures of 600 F. We made the area habitable by building a pair of frames, as shown in the sketch, to carry aluminum insect screening. The screening, placed next to the pumps, cuts off most of the radiant heat, making things more comfortable for the operators. The pumps can be easily inspected through the screens. For maintenance they are easily removed.

J D CONSTANCE *Cliffside Park, N. J.*



For more plant-tested ideas, turn page→



TIGHT! STRONG! for even toughest blow-down requirements

The Yarway Unit Tandem Blow-Off Valve meets the most demanding requirements for boiler blow-down or drain service.

It's drop-tight—and rugged enough to withstand the severe punishment of regular or emergency blow-down under pressure, or periodic acid wash.

Two Yarway Stellite-Seat Hard-Seat Valves or a Hard-Seat (blowing) and Seatless (sealing) Valve are combined in a one-piece forged-steel body. Designed for pressures up to 2500 psi.

It is significant that more than 4 out of 5 high pressure boiler plants use Yarway Blow-Off Valves.

For more facts, see Yarway Bulletin B-432.

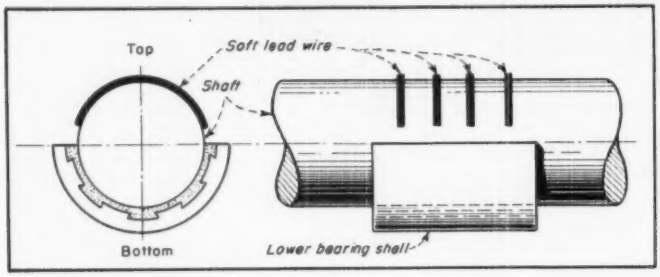
YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
Branch Offices in Principal Cities

YARWAY

BLOW-OFF VALVES

 (*Continued from page 122*)

LEAD WIRE CHECKS BEARING ALIGNMENT AND CLEARANCE



THE U. S. NAVY uses a simple method for checking alignment and clearances of split bearings. The method applies to babbitted bearings without need for disassembling a machine. Only the bearing cap and upper bearing shell need be removed.

Place several pieces of soft lead wire equal in length, on the shaft, as shown in the sketch. Narrow strips of lead of uniform thickness will do if the wire form is not available. Thickness of the lead should be not more, or only slightly more, than the allowable diametral bearing clearance. Usually clearance equals the journal diameter divided by 1000.

Clean thoroughly the surfaces of bearing and cap at the split. Place the upper bearing shell and cap in position. Turn down the nuts on the bearing studs till solid metal-to-metal contact occurs between housing and shell and at the split. Do not tighten so as to deform the thread. Mark the positions of the individual nuts. If alignment and clearance are correct, the nuts should be tightened to this position after the lead has been removed.

Remove the bearing shell and cap and take off the lead wires. Pin them to a piece of paper in the same relative position as on the journal. For wires squeezed out evenly and symmetrically the clearance is uniform. If leads are wide and thin in some places, and narrow and thick in others, the clearance is irregular. Measure the thickness of the leads with a micrometer at several places in order to find the amount of clearance.

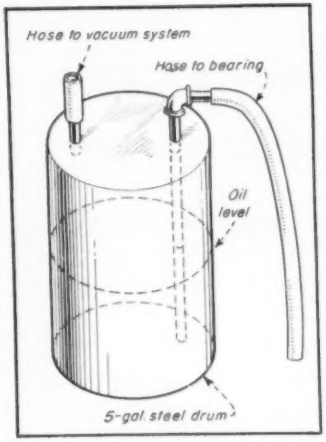
If the leads are irregular in shape the bearing should be rebabbitted. If the shape of all leads is symmetrical and thickness at centers equals the bearing clearance, the bearing is correctly aligned with proper clearance. For leads smaller in thickness than the required clearance (at its narrowest point) the clearance is too small and the bearings should be rebabbitted or scraped.

If shape of the wire has not changed at all, the bearing clearance is too large. If the wire at one end has a different shape from that at the other end, the bearing is misaligned (provided it is not self-aligning type with spherical seat).

Check that no clearance exists between journal and the lower bearing shell, before using this method. Metal-to-metal contact must exist at the lowest shaft point, that is, the shaft must be seated in bearing.

H W HAMM *York, Pa.*

VACUUM-TANK TOOL CLEANS HARD-TO-GET-AT BEARINGS



THE INTERNAL ROLL JOURNALS on our bowl-mill-type coal pulverizers are accessible only through plugged inspection holes at the top. Because these mills operate a minimum of 10,000 hr without coming out for repair, it has frequently been necessary to renew the oil in the bearings. The oil becomes fouled with coal dust, causing a potential hazard to bearings.

To get at the oil meant taking the mill out of service to pull and dismantle the journal assembly, even though no other repairs were needed. To avoid this operation our staff rigged up the vacuum tank in the sketch. A 5-gal steel drum was fitted with one pipe leading almost to the bottom internally, with another just projecting through the top. The entire drum must be sealed tightly. The short connection ties into the plant vacuum system. The long pipe connection is joined to a ½-in. rubber hose of suitable length. The hose inserts through the journal inspection hole to the bottom of the bearing. Turning on the vacuum valve quickly draws out the oil. It's a simple matter to pour in fresh oil. If necessary the journal can be flushed with kerosene before filling with clean oil.

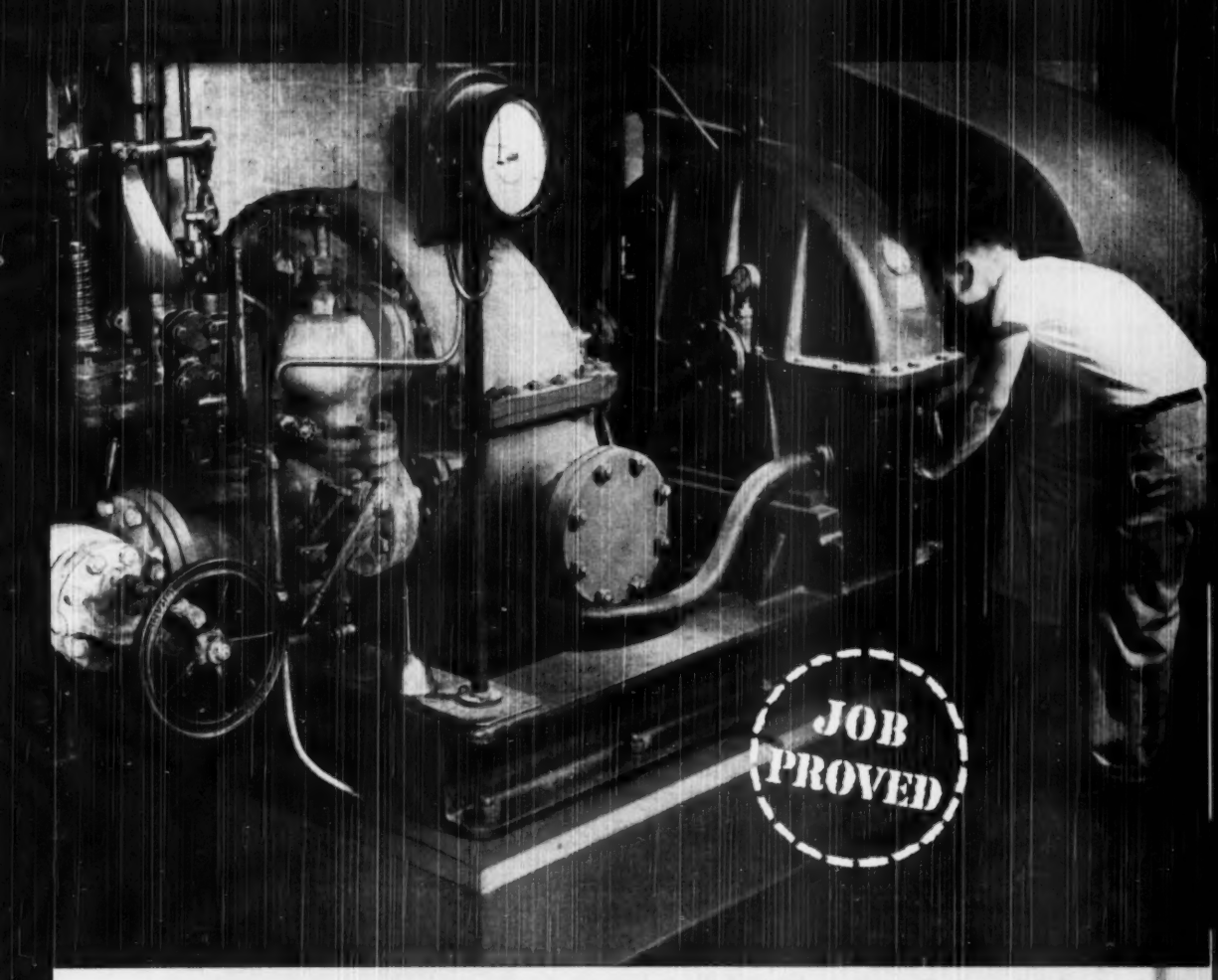
This operation can be safely performed in a few minutes, even without taking the mill off the line. It has proved a convenient tool for drawing off excess oil poured into the bearing. Merely insert the end of the hose at the desired oil level and draw excess off into the vacuum tank.

The tank has often been found useful for other purposes around the plant. We keep it as a permanent part of our station equipment.

J A SWANSON *Princeton, B. C.*

LET YOUR IDEAS HELP OTHERS

Power men advance by an exchange of ideas. Such exchange is a 2-way street. Why not tell us about successful solutions *you* have used for problems in design, maintenance and operation? Your manuscript need give only the bare facts, with sketches in pencil. We'll dress them up for publication. To boot, POWER pays you $20 for each idea.



SUNVIS 900 OILS REDUCE COSTS 25%

Papermaker Gets Maximum Equipment Protection, Extra Long Service, from Superior Turbine Lubricants

In a large paper mill, eight steam turbines drive paper machines and pumps, and generate power for ventilating equipment. Ten years ago the mill began lubricating these turbines with a "Job Proved" Sun oil. They gave unfailing service with remarkably low oil and maintenance costs.

Four years ago, when Sunvis "900" Oils first became available, the Sun representative serving the mill saw an opportunity to effect even greater economy. He suggested that the medium-priced Sun oils in use be replaced by the more costly Sunvis "900" Oils. He knew that these modern, fortified lubricants—*more costly* on a per-gallon basis—would prove *less costly* through the years because of their remarkably long life. His suggestion was followed.

The Sunvis "900" Oils have fully justified this confidence, saving the mill 25% or more on lubrication costs. Furthermore, the papermaker knows his equipment—running or idle—is fully protected from rust and corrosion.

Sunvis "900" Oils are *good for the life of your production equipment*. Coupled with the know-how of the Sun representative who calls on you, they are good for your pocketbook, too. For more information, send for a copy of the illustrated booklet "Sunvis '900' Oils". Write Department P-10.

SUN OIL COMPANY • *Philadelphia 3, Pa.*
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Toronto and Montreal

SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY

SUNOCO®

PROBLEMS FROM THE PLANT

THIS MONTH'S QUESTION

How Can We Accurately Measure Blowdown?

FOR SEVERAL MONTHS we've been trying to measure blowdown from our six watertube boilers. But every method seems greatly in error.

First, we tried weighing the blowdown in barrels. We lost so much by evaporation that we figured results were way off. Next, we tried an orifice in each blowdown line. Orifices wore rapidly and were out of round in a few weeks. Same thing happened with flow nozzles. Latest method we've used is marking drum gage glasses. This is accurate but wastes quite a bit of time.

Now here's the problem. We have to get an accurate estimate of daily blowdown. But we haven't enough men in the plant to let an operator spend an hour or so on this job. What we need is a fast, accurate method of finding quantity blown down.

Have any POWER readers come across a practical method of measuring blowdown that doesn't cost too much and is easily built? We'd appreciate sketches and piping diagrams showing how we can make one ourselves.—*KT*

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Readers Answer the July Question

Why Does Exhaust Line Leak, Brickwork Crack?

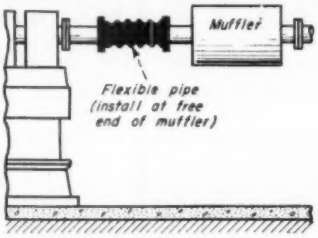
(This question from the July issue is followed by best answers from readers.)

WE HAVE A 6-cylinder 14x17-in. 575-hp 2-cycle diesel driving a 400-kw generator. Our exhaust system gives us all kinds of misery. Sketch [July, p. 134] shows how it's connected.

Exhaust line runs horizontally from engine through muffler into a common brick stack. Several 6-in. process-steam lines run above and below the muffler. All are well insulated. Exhaust line has flanges at engine, muffler and stack entrance. When engine was installed we were told exhaust line was designed to expand into stack.

Here's our problem. Flanges at engine and muffler tend to spring, allowing gases to escape to engine room. Besides, stack brickwork has cracked around exhaust inlet and several feet above it. We've tried tightening up flanges, coating brickwork with cement, but haven't had any luck.

Will POWER readers who've been around diesels give us sketches showing how to connect our exhaust system? Do steam pipes affect flanges in exhaust? Also, we'd like to know why flanges spread and brickwork cracks.—AK



Try Flexible Pipe

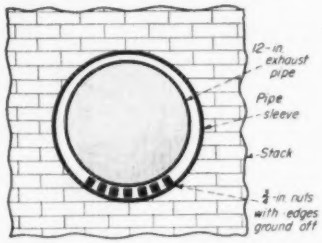
I KNOW WHAT *AK* is up against because I've had the same trouble. It seems like a minor problem but cure is difficult.

Install piece of flexible exhaust pipe as in sketch. This will take care of flange leaks. He'll have to figure just where to put it because one end of muffler may be fixed. Don't put it at that end. He may need a flexible pipe at both ends but usually one will do.

If exhaust enters stack through heavy cast-iron thimble he should take it out and put in a light steel one. Cast iron may expand and crack brick. Also, check stack-expansion joint. It may be "frozen" from heat and rain water.

Steam pipes do not cause flange leaks unless they rest on some part of exhaust piping and deflect it.

E A ROBERTS *Carlsbad, N.M.*

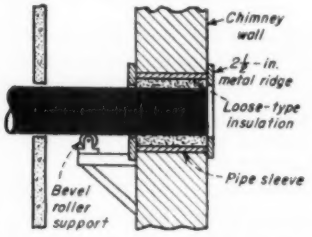


Let Pipe Slide on Nuts

AK IS LUCKY to have only loose flanges and gas leaks. On some engines a poorly installed exhaust line may crack jackets.

He should try using a corrugated expansion joint between engine and muffler. Also, an elbow turned to direct exhaust gas upward helps reduce back pressure. Support end of exhaust line on nuts as in sketch. These are ¾-in. nuts with edges ground off. Pipe slides freely over them. Use pipe sleeve around exhaust pipe. Process-steam lines do not affect diesel exhaust line.

VINCENT STROJSA *Glace Bay, N.S.*



Use Stack Expansion Joint

RIGID CONNECTION at stack probably causes cracks and leaks. Vibration may also be a cause.

Use an expansion joint with an anchor at chimney, or design chimney entrance as shown in sketch.

MELVIN EVANS *Chicago, Ill.*

For more plant-problem answers, turn page →

Prevent Return Line Corrosion

with

FILMING AMINES*

HERE'S AN exciting *new* development in the Water Conditioning Field!

Corrosion of steam and condensate return lines is a serious problem to most industrial plants. Such corrosion is caused by the presence of carbon dioxide and oxygen. Up to now, it has been the usual practice to neutralize the carbon dioxide. However, the high cost of this neutralization method has limited its application. And, no protection against oxygen corrosion is assured.

Betz Laboratories have developed a new, advanced process for the prevention of return line corrosion employing *octadecylamine*. This material *does not* neutralize the carbon dioxide. Instead, the amine is adsorbed on the metal surfaces in a monomolecular non-wettable film which acts as a barrier between the metal and the condensate, protecting against both oxygen and carbon dioxide attack. The monomolecular film does not increase in thickness with continued treatment. Results? As high as *99 percent reduction* in corrosion rate has been achieved!

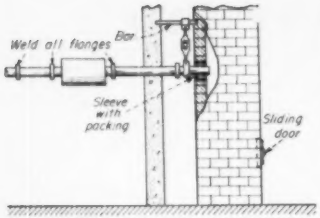
Let a Betz Field Engineer show how you can cut costs in your plant with the use of filming amines. Write today! There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Sts., Philadelphia 24, Pa. In Canada: BETZ Laboratories, Limited, Montreal 1.

Send for Betz Technical Paper #120, "How Filming Amines Prevent Steam and Return Line Corrosion".

*U. S. PATENT 2,460,259

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT



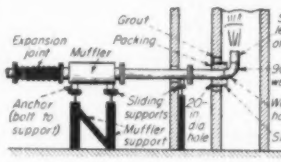
Weld All Flanges

CHANGES IN TEMPERATURE cause flange leaks. *AK* should check exhaust temperature, engine valves and timing. He may have trouble there.

Tightening flange bolts won't do much good. Weld all flanges so there's no chance of leaks. Then try to create natural draft in stack by removing a few bricks near base, allowing cold air to enter. If this works, fit a sliding door, sketch. Door can be positioned to give best draft under varying conditions.

Put packed sleeve in brickwork and support pipe with bar and turnbuckle.

GEORGE MCNALLY *Kearny, N. J.*



Double-Edged Cure

AK HAS TWO PROBLEMS: (1) transmission of vibration along exhaust line through flanges to stack (2) lack of proper support for exhaust line causing flanges to spring.

My sketch shows correct installation. Use flexible expansion joint between engine and muffler to prevent vibration. Muffler must be supported. Anchor end nearest expansion joint and leave other end free to slide. Use sliding support outside wall also.

Exhaust pipe should not rest on chimney brick. It should pass through a large hole, 18-in. diameter for 12-in. pipe. Center in hole with about 2½-in. clearance all around. Reinforce with pipe sleeve and pack with an insulator.

On the off chance that chimney cracks have thermal origin, terminate exhaust line with 90-deg-long radius welding elbow. Add short piece of pipe to direct exhaust gas up chimney and not against chimney brick. Drill a ½-in. diameter weep hole in lower side of ell to prevent accumulation of rain water. Reroute process-steam lines to make room for muffler support, if necessary.

A M PALMER *Brooklyn, N. Y.*

Trouble at Stack End

LINE DOESN'T EXPAND into stack as claimed. Instead, it must be rigidly fastened. Result is that thermal stresses and mechanical vibrations crack brick and spring flanges.

It will pay *AK* to check that stack connection carefully. If there's a solid connection, chip a hole large enough to prevent line from binding. Install supports that carry weight of exhaust line, but do not restrict expansion. Then pack hole with plastic sealing compound. Line should now be rigid enough yet free to expand and contract without cracking brick.

D H NOBLE *Wilmington, N.C.*

Anchor at Wall

AK CAN SOLVE HIS PROBLEM by using an expansion joint between engine and muffler, insulating the exhaust line and anchoring at wall. Anchor should prevent all vertical and horizontal movement of exhaust pipe.

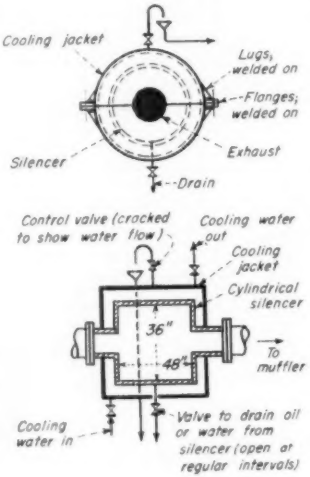
W F ELKINS *Atlanta, Ga.*

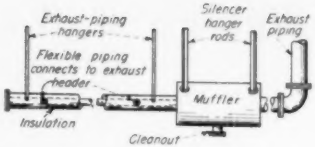
Water-Cooled Silencer

AK CAN MAKE the simple water-cooled silencer shown in sketch. Install it as close as possible to engine. Hook up silencer cooling system with that of engine. If it's too expensive to build silencer, try enclosing present cooling line with a water jacket. This should not go over flanges. Fit with water-control valve.

Remember, flange bolts should be tightened after the engine has run awhile. An opening in bottom of stack may relieve some of the pounding caused by exhaust gas.

A VERSTOEP *S. Williamsport, Pa.*



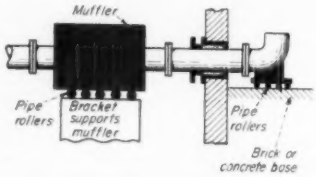


Firebrick Stack Lining

USE FLEXIBLE PIPE between engine exhaust manifold and exhaust header as in sketch. Insulate exhaust piping to reduce engine-room temperature. Support piping and muffler from above. Usual practice is to use several hangers.

If *AK* must use stack, I suggest installing pipe for about 10 ft above elbow. Stack should be lined with firebrick instead of cement for best service. Allow some clearance around exhaust pipe where it passes through stack, and pack opening around it with asbestos rope. This eliminates cracking from heat and vibration.

ARTHUR BELTON *Montreal, Canada*



Roller Supports Good

ALLOW EXHAUST LINE to move horizontally as in sketch. Use stuffing box where line enters stack and an elbow to direct gas upward. Coat interior of stack in high-temperature zone with heat-resisting cement, or lay in firebrick, leaving air space between it and stack.

C H HUGHES *Staten Island, N. Y.*

Vibration May Do It

VIBRATION MAY DISINTEGRATE brickwork and cause stack to fall. Or there may be an accumulation of explosive material, which will demolish stack when ignited. Exhaust piping appears to be heavy and offers much resistance to movement

When engine operates, vibration is set up in exhaust pipe partly by engine itself and partly by exhaust pulsations. Expansion of piping causes additional strains. Accumulation of all these strains causes flanges to leak.

Quickest, easiest and most inexpensive solution is:

(1) Remove solid exhaust pipe between manifold and muffler and replace with flexible pipe. This will take

(*Continued on page 160*)

11 YEARS on the Line

✓ No Maintenance
✓ No Downtime

THIS ROCKING CONTACT VOLTAGE REGULATOR has been on the line without downtime or maintenance since installed eleven years ago!" says Mr. Kudick, engineer-in-charge of the East Wells Street Power Station of the Wisconsin Power Company in Milwaukee. "This regulator was installed to hold down voltage peaks . . . it does the job. Performance has been excellent."

What are reasons behind this typical performance?

1. Allis-Chalmers Rocking Contact Generator Voltage Regulators have no vibrating contacts, no gliding friction, no complex adjustments. The few moving parts are all supported in jeweled bearings.
2. They are genuinely precision manufactured. Sectors rock on accurately machined commutator segments that are silver surfaced for positive contact, long life.

If you want long years of trouble-free service, specify *Rocking Contact* Generator Voltage Regulators for your next switchgear or switchboard . . . or replace inefficient regulation now! Call your nearby Allis-Chalmers representative or write direct for more information.

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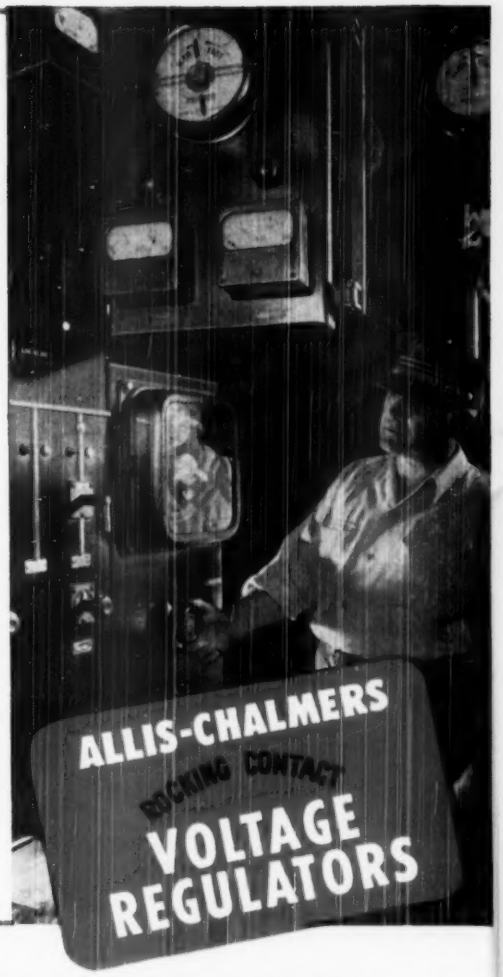
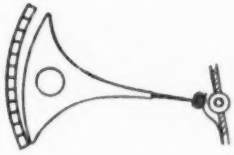
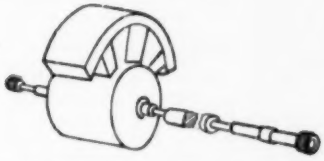


WHY POWER ENGINEERS IN UTILITIES AND INDUSTRY PREFER ALLIS-CHALMERS ROCKING CONTACT REGULATORS:

Each commutator segment is connected to a wire wound resistance element that is accurately designed according to the characteristics of *your* generating equipment. Resistance elements are air cooled —commutator is in dust-tight enclosure.



Rocking Contact sector pivots on jeweled bearing . . . has smooth working, hard graphite face that rocks on curved, silver surfaced commutator . . . regulates with slight movement . . . reduces wear . . . maintains accuracy.



Quick acting torque motor drives Rocking Contact Sector . . . has jeweled bearings for rapid, accurate, anti-friction movement. Aluminum rotor reduces inertia . . . increases speed of response.

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TECHNICAL BRIEFS

ENGINEERING DEVELOPMENT HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

REVIEWED IN THIS ISSUE

SMOKE PREVENTION: Report of Subcommittee on Standards for Emission of Solids • Reduction of Pressure Drop Across Dust Collectors

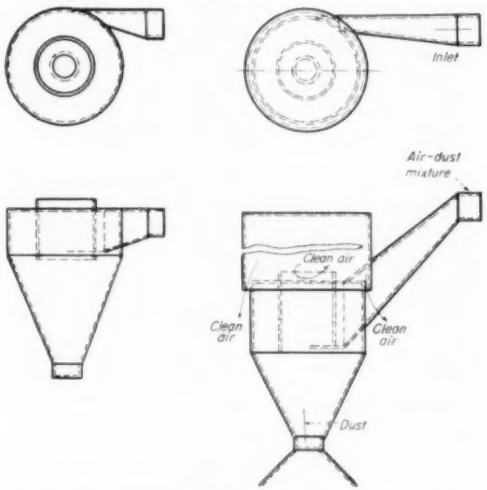
AIR CONDITIONING: Design Considerations, Steam Absorption Air-Conditioning Units

GAS TURBINES: Gas-Turbine Combustors for Gaseous Fuels • Producer Gas for Gas Turbines • A Progress Report on Gas-Turbine Combustors for Pulverized Coal • Engineering and Construction Problems Involved in the Huey Gas-Turbine Installation • Safety Margins and Stress Levels in High-Temperature Equipment

Directions for ordering papers are given on page 132

PROPOSED ALLOWABLE EMISSIONS: BOILER CHIMNEYS

Steam from all units connected to stack, lb per hr	*Permissible emission, lb dust per hr*	*#Dust/1000# Gas @ 1.5# Gas/#Steam*
10,000	22	1.46
20,000	45	1.5
30,000	67	1.49
40,000	90	1.5
50,000	112	1.51
60,000	134	1.51
80,000	180	1.5
100,000	224	1.48
150,000	284	1.26
200,000	334	1.11
300,000	419	0.93
400,000	489	0.81
500,000	552	0.74
600,000	609	0.67
800,000	709	0.59
1,000,000	798	0.53
1,500,000	1200	0.53
2,000,000	1600	0.53
3,000,000	2400	0.53
4,000,000	3200	0.53



REDUCING PRESSURE of typical centrifugal separator, *left*, is done by building inlet pipe higher, *right*, curving downward

Smoke Prevention

REPORT OF SUBCOMMITTEE ON STANDARDS FOR EMISSION OF SOLIDS FROM CHIMNEYS, *by J H Carter, Chairman, St. Louis, Mo.* This is the work of a standards committee set up in 1947 by the Smoke Prevention Assn of America. Membership included representatives of dust-collector manufacturers, air-pollution control officers, and consultants.

This committee report is the most practical and sensible approach to atmospheric pollution that has yet come to light. Here are examples of the good reasoning this committee displayed; Table shows the proposed emissions.

Only logical approach, the committee felt, was to determine, on the basis of good engineering practice, what could be expected of boiler plants, equipped with dust-collecting apparatus, in the way of optimum performance, then to set limits for every plant as low as practicable. If a plant meets this limit no more can be reasonably asked. If, performing at that level, a plant still creates a nuisance it is the prerogative of the injured locality to evaluate the economic factors involved in the question of plant against neighborhood.

Logical step-by-step reasoning brought to light by this stated approach is further developed in the committee's comments on various factors influencing the setting of allowable limits. *SPAA paper. No number.*

REDUCTION OF PRESSURE DROP ACROSS CYCLONE DUST COLLECTORS, *by F B Schneider, General Electric Co.* Independent of design all cyclones, from the ancient centrifugal dust collector to the modern vortex, suffer from a common handicap. This disadvantage is the large pressure drop caused by the whirling motion of the gas while performing the cleaning action. In addition, with higher dust-separation efficiency, the pressure drop increases, so the highly efficient vortex has a pressure drop that is a multiple of the pressure drop of the common centrifugal separators.

For the centrifugal separator, a large number of tests show that the rotating flow has almost constant angular velocity. These separators are built solely for the purpose of attaining normal separation with the lowest possible rotary motion and lowest possible pressure drop, restricted only by practical consideration of size and cost. Size of the collector depends on the diameter of the inlet pipe only. Some modern installations have inlet pipes 3 ft dia.

One simple way to reduce this pressure loss is to build the inlet pipe much higher than usual (figures above) and curve it downward toward the collector inlet. Enlarge the descending part of the duct gradually until air velocity at the inlet is down near the desired level.

Anaconda heat exchanger tube advice is—

AUTHORITATIVE

Tube bundles for high pressure feed water heaters in central station power plant. Tube material, ANACONDA Copro Nickel. Coils fabricated by Carl Bobke, Coppersmith, Milwaukee, Wis. Feed water inside tubes, steam outside bled from plant turbines.

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HEAT EXCHANGER TUBES

The author presents several other pressure-reducing suggestions for the centrifugal collector as well as for the vortex unit. *General Electric Review, Feb.* 1950.

Air Conditioning

DESIGN CONSIDERATIONS AFFECTING SELECTION OF STEAM-ABSORPTION AIR-CONDITIONING UNITS FOR MASSACHUSETTS MUTUAL LIFE INSURANCE CO BUILDING, NEW YORK CITY, AND DETROIT FREE LIBRARY, *by Alfred L Jaros, Jr, Jaros, Baum & Bolles, Inc.* The new Massachusetts Life Insurance Building is a typical, modern New York structure. It has about 5½ million cubic feet on a plot about 25,000 ft sq. Building is to be 26 stories high with lower floors covering most of the plot. Upper floors are set way back and topped with a tower.

It will be the first large building in New York with Robertson Q-Panel floors instead of cement slabs. Further, it will be the largest installation to date of steam-absorption refrigerating machinery, 1100-ton total capacity. Forty-two 75-ton absorption units will be mounted 26 stories above the street. With this scheme the entire basement is freed for tenant use.

Another count in favor of absorption refrigeration is its operating economy at low loads. It is almost as efficient at 20 to 50% capacity as it is at close to 100%. There is still another advantage. If desired, the absorption machine can give good operating results working with steam at 15 psi or lower. In the Massachusetts building 60 psi was selected because of savings in first cost, about 15 to 20%, over the lower-pressure unit.

The chilled-water pumps are in the basement, some 20 or 25 ft below the street. While no extra horsepower was needed a special reinforced casing had to be used.

Author discusses additional problems faced and solved, such as the paralleling of four large absorption machines. *NDHA paper. No number.*

Gas Turbines

GAS-TURBINE COMBUSTORS FOR GASEOUS FUELS, *by K L Ricks and A E Hershey, Westinghouse Electric Corp.* One likely looking application for the gas turbine seemed to be as booster unit for natural-gas pipeline pumping. A gas turbine, burning natural gas and driving a centrifugal compressor, has a number of advantages, including small floor space and foundation, as well as a reduced power requirement for auxiliaries.

Finally, the experimental Westinghouse 2000-hp gas turbine unit was modified to handle the job. Problems involved in modifying the unit were considerable because natural gas had never been burned in such a unit.

A set of typical test conditions were worked up corresponding to full load, half load, idling operation. In some, net heating values of 21,100 Btu per lb have been tabulated.

Some rather interesting experiences were recorded with different gas burners. Principal burners under test are broadly classified as: (1) premix, where gas and oxygen mix in varying proportions before entering combustion zone (2) diffusion type, where gas and oxygen meet in combustion chamber only.

Chief difference determined was that combustion rate for diffusion burner was fixed by rate of gas mixing. In the premix, rate was a characteristic of the fuel, fuel-air ratio, and state of combustible mixture. *ASME paper. No number.*

PRODUCER GAS FOR GAS TURBINES, *by B O Buckland and Arthur Y Hillman Jr, General Electric Co, and W H Nelson, Battelle Memorial Institute.* One feasible way of using coal in a gas turbine is to gasify it under pressure and supply the resultant gas to the gas turbine. The pressure produced by a gas-turbine compressor (5 to 9 atmosphere) should allow high firing rates without immeasurably high solid carryover rates. Hot make-gas, with the tars contained in it in vapor form, can be used in the gas turbine.

Most of the ash is removed through a grate. Only a small portion of it and any of the solid combustible material carried over by the make-gas require separation. The gas stream from which separation is required is a small portion of the total flow of gas-turbine plant, and hence separator size will be small.

A series of 67 tests using bituminous coal and 26 with coke have been run on a small-scale gas producer. Coal gasification rates as high as 140 lb of coal per hr per sq ft of grate area were reached at blast rates of about 500 lb per hr of air. Increased blast rates increased carryover, clinker and fuel-bed temperatures. Gas quality did not change significantly, under load changes from 150 to 500 lb-per-hr air rate.

Blast preheats up to 1150 F have been run. Increases in preheat improved gas quality, lowered make-gas temperature and increased clinker formation. Increase in operating pressure up to 7 atmospheres reduced clinker and carryover with no detrimental effect on gas quality. The producer responded to rapid load changes and its control requirements were simplified by this response. A watercooled retort wall had to be put in to prevent slag sticking to wall. A coke breaker and bed stirrer prevented fuel arching. *ASME paper. No. 50-SA-33.*

A PROGRESS REPORT ON GAS-TURBINE COMBUSTORS FOR PULVERIZED COAL, *by Herbert R Hazard, Battelle Memorial Institute.* Important component of a gas turbine using pulverized coal is the combustion chamber or combustor where coal is burned. Operating conditions under which satisfactory combustion must be maintained include heat release rates per unit of volume of 50 to 100 times those in boiler furnaces, variable static pressure ranging from 30 to 75 psia, and variable air-fuel proportions ranging from 6 to 20 times the stoichiometric ratio (that is the theoretically perfect oxygen-to-fuel ratio).

Full-scale combustors under development by Locomotive Development Committee have been tested at atmospheric pressure. Performance characteristics of several different designs of combustors have been determined.

Subsequent experience with the Houdry gas-turbine unit developed by this same committee has demonstrated that combustor performance at 53 psia is better than at atmospheric pressure. *ASME paper. No. 50-SA-41.*

ENGINEERING AND CONSTRUCTION PROBLEMS INVOLVED IN THE HUEY GAS TURBINE INSTALLATION, *by C C Willis, Oklahoma Gas & Electric Co, E C Goldsworth, General Electric Co.* Huey Station started out in 1930 as a coal-fired installation with three 150,000-lb-per-hr boilers developing steam at 400 psi and 750 F and a 30,000-kw turbine-generator. But since gas fuel was so readily available in the Oklahoma City

(*Continued on page* 156)

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources unless otherwise noted:

American Society of Mechanical Engineers, spring and semiannual meetings: Washington, D. C. April 12-14; St. Louis, June 19-23. Papers are identified by initials ASME. Obtainable through ASME, 29 W 39th St, New York 29, N. Y.

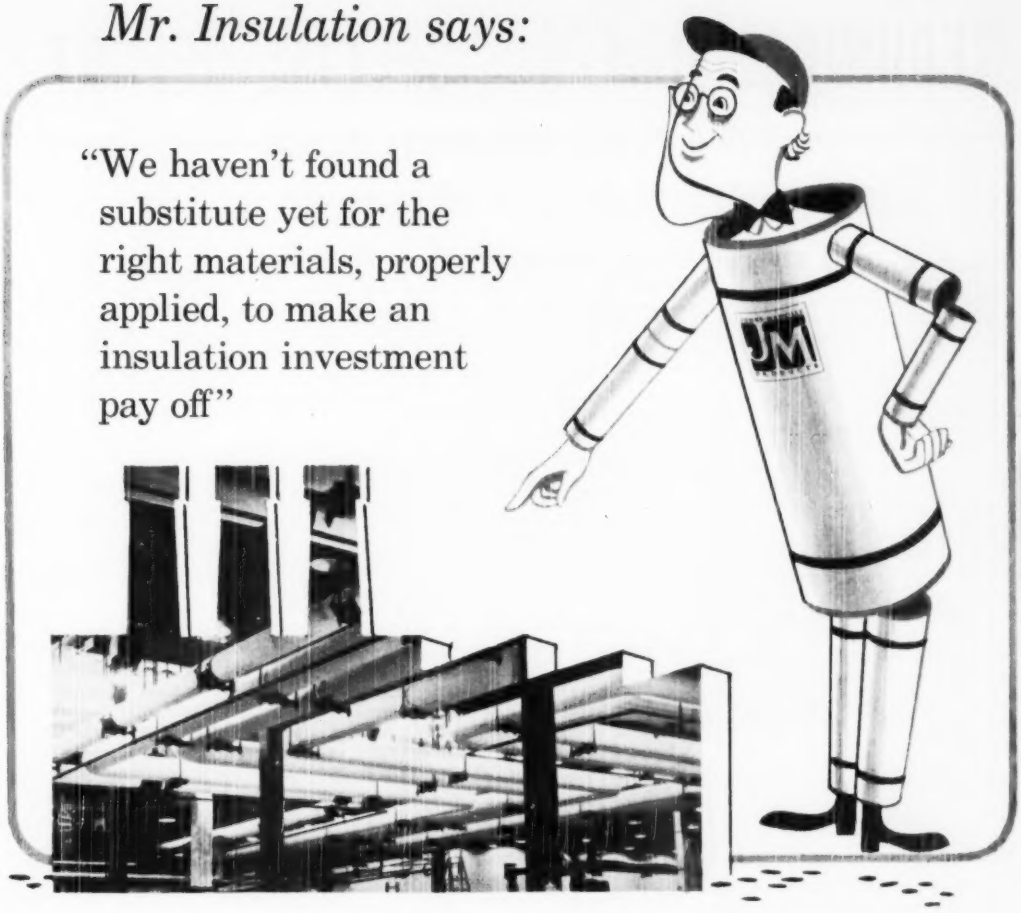
Smoke Prevention Assn of America, annual meeting, Montreal, Quebec, May 21-25, 1950. Papers are identified by initials SPAA. Available through J H Carter, Air-Pollution Director, City Hall, St. Louis, Mo.

National District Heating Assn, annual meeting, Asheville, N. C., May 23-26, 1950. Papers are identified by initials NDHA. Obtainable through John F Collins, Jr, secy, NDHA, Pittsburgh.

For briefs on world power conference, turn page →

Mr. Insulation says:

"We haven't found a substitute yet for the right materials, properly applied, to make an insulation investment pay off"



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WORLD POWER CONFERENCE PAPERS

- Atomic Energy
- Water Power
- Gas Turbines
- Internal-Combustion Engines
- Steam Generation
- Turbine Practices
- Fuels and Firing
- Power-Station Design

Atomic Energy—Section J

DEVELOPMENT OF POWER FROM NUCLEAR ENERGY, *by Sir John Cockcroft, director, Atomic Energy Research Development.* Paper No. 1. Summarization of technical problems.

NUCLEAR ENERGY FOR POWER PRODUCTION—I, *by W F Davidson, research engineer, Consolidated Edison Co of N. Y.* Paper No. 3. Development of the problems and an indication of some of the as-yet-unreported, unsolved research phases with a prediction that nuclear power plants are definitely a possibility.

LES PROGRESS DE L'ENERGIE NUCLEAIRE EN FRANCE, *by L Kowarski, directeur Scientifique au Commissariat a l'Energie Atomique, Paris.* Paper No. 2. Description of the organization set up in France and equipment involved.

ATOMIC ENERGY DEVELOPMENT IN CANADA, *by David A Keys, vice-president, National Research Council of Canada.* Paper No. 4. Report of Canada's organization as well as equipment concerned with this problem.

Water Power—Section H 1

GENERATION OF HYDRO ELECTRIC POWER IN CANADA, *by Dr Otto Holden, asst genl mgr, Hydro-Electric Power Commission of Ontario.* Paper No. 1. Rapid progress in power development in Canada was stimulated largely by World War II. Paper notes the great value of river-flow data recorded by the Water and Power Bureau.

SWEDISH PRACTICE IN WATER DEVELOPMENT, *by G Westerberg, chief director, Civil Engineering Dept, State Power Board, and Professor B Hellstrom, consulting engineer.* Paper No. 2. Trend of Swedish water-power development plus design features required by economy and geological conditions.

STATE OF HYDROELECTRIC POWER DEVELOPMENT IN *U. S., by E R De Lucca, chief, Bureau of Power, and F L Weaver, chief, div of River Basins, U. S. Federal Power Commission.* Paper No. 3. First part develops the growth of water power and second deals with design points.

PRODUCTION OF HYDROELECTRIC POWER AND THE PROBLEMS OF IRRIGATION IN NORTHERN ITALY, *by Marco Semenza, ingenieur conseil, Italian National Committee.* Paper No. 4. Irrigation of the plains of the River Po and its concurrent development of power.

LES GRANDS RESERVOIRS ET LA REGULARISATION DE LA PRODUCTION ELECTRIQUE IN ITALY, *by Dott. Ing Luigi Selmo, directeur, Societe Idroellectrica Piemonte.* Paper No. 5. Storage reservoirs are advanced as a means of regulating the power output of river with a variable discharge. Special reference is made to Italy.

RECURSOS POTENCIALES DE ENERGIA HYDROELECTRICA DE CHILE, *by Prof Ing Reinaldo Harnecker, gerente tecnico de las Empresa Nacional de Electricidad S. A.* Paper No. 6. Systematic electrification in the past ten years has realized much of the hydroelectric resources of Chile as outlined in a World Power Conference paper, 1936.

WATER POWER AND LAYOUT OF INDUSTRIAL PLANT IN INDIA, *by P A Stoffel, technical representative, Escher Wyss Engrg Wks, Indian National Committee.* Paper No. 7. Possibilities of industrial development by use of the great potential water-power resources.

PROJECTED HYDROELECTRIC POWER DEVELOPMENT IN INDIA AND STUDIES OF ECONOMIC PLANNING OF POWER TRANSMISSION AND INTERCONNECTION OF POWER SYSTEMS, *by S A Gadraky, member, Central Energy Commission, and M S Thacker, head, Power Engineering and Electrical Technology, India Institute of Science, Indian National Committee.* Paper No. 8. Outline of rapid hydroelectric power growth in India now at 500,000 kw. projected to 5,700,00 kw.

STATISTICS OF ALL EXISTING WATER-POWER RESOURCES, *by Dr Ing Vladimir Slebinger, engineer to State Water Economics Committee, Yugoslav Committee.* Paper No. 9. An effort to assess total water-power resources of the world, set by the author as 5600 million kw with a probable error of ± 15%.

HYDROELECTRIC DEVELOPMENTS IN THE SCOTTISH HIGHLANDS, *by Sir Edward MacColl, deputy chairman, North of Scotland Hydroelectric Board, British National Committee,* Paper No. 10. Water power in the Highlands. Estimated potential is 6300 million kwhr annually, about one sixth the present load on the grid.

ELECTRIC POWER TRANSMISSION AND DISTRIBUTION IN CANADA, *by W R Way,* genl supt, Shawinigan Water and Power Co, Canadian National Committee. Paper No. 11. Of particular interest to electrical engineers, it deals with current practices and future trends in transmission and distribution.

UEBER DIE WIRSCHAFLICKE GESTALTUNG DER DROMVERSORGUNGSLANLAGEN VON WESCHSELSTROMBAHNEN, *by Dipl Ing Heinrich Schmidt.* Paper No. 12. Devoted principally to transmission of electric energy to railways.

REPARTITION DES NOUVELLIS PUISSANCES THERMIQUES ET HYDRAULIQUES INSTALLEES EN ALGERIE, *by P Crosnier, director general, Adjoint d'Electricite et Gaz d'Algerie.* Here the problem of apportioning electrical load between thermal and hydroelectrical sources of supply is discussed as it applies to the expansion of Algiers.

Gas Turbines—Section G

LA TURBINE A GAZ DANS L'INDUSTRIE ET DANS LES CENTRALES THERMIQUES, *by W Karrer, Ingenieur in chef, Ateliers de Construction Oerlikon, Zurich.* Paper No. 1. The gas turbine in association with efficient steam-turbine condenser for power generation and its advantages.

SOME TECHNICAL ASPECTS AND APPLICATIONS OF CLOSED-CYCLE GAS TURBINE SYSTEM, *by Dr C Keller, Swiss National Committee.* Paper No. 2. New cycle

(*Continued on page 204*)

HOW TO OBTAIN TEXT

Limited stocks of individual papers are available at 2 shillings each. A few complete sets of 156 papers and 19 general reports are available at 3 pounds plus postage. Orders should go to Messrs Percy Lund, Humphries & Co, Ltd, 12, Bedford Square, London, W. C. 1, England.

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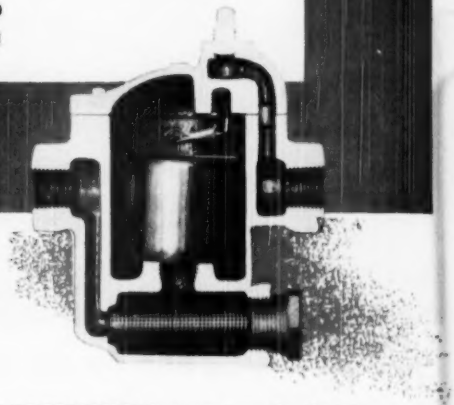
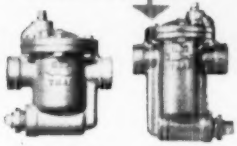
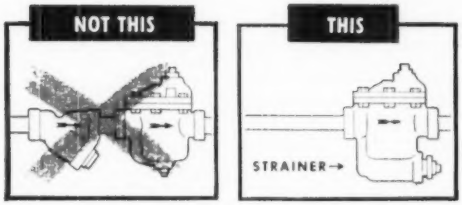


VITAL STATISTICS



	No. 880	No. 881
Pipe Connections	½" or ¾"	½" or ¾"
Operating Pressure	150 psig	250 psig
Capacity, lbs. per hour continuous discharge	450-690	760-1060
Height	5⅞"	7 1/16"
Diameter	5"	5"
Weight	5 lbs.	6 lbs.



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POWER NEWS

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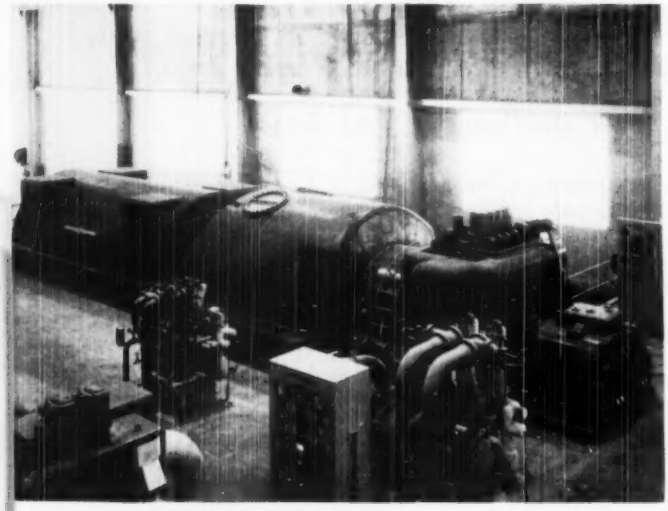

Moss Landing Steam Plant Goes Into Service

First of three 100,000-kw generators went into service at the new Moss Landing Steam Plant of Pacific Gas and Electric Co, Monterey, Calif., 18 months, 23 days after ground was broken. interesting feature is an "underwater service station" in Monterey Bay, 3500 ft off shore, where oil tankers discharge fuel oil through a sea hose connected to a pipeline, on the ocean floor, that feeds to the shore. This supplies four 120,000-bbl storage tanks; 20-in. natural-gas pipeline will be connected

COMING EVENTS

Oct 2-5—Technical Assn of Pulp and Paper Industries, engineering meeting, Netherland Plaza, Cincinnati, Ohio. R T Bingham, TAPPI, 122 E 42nd St, New York, N. Y.

Oct 16-18—Engineers' Society of Western Pennsylvania, Eleventh Annual Water Conference, Hotel William Penn, Pittsburgh, Pa. W M Porter, secy, ESWP, Hotel Wm Penn.

Oct 19-21—Institute of Power Engineers of Canada, 1950 Convention. Windsor Hotel, Montreal 1, P. Q. General Secy, Institute of Power Engineers, 496 Church St, Toronto 5, Ontario.

Oct 23-27—American Institute of Electrical Engineers, fall meeting, Skervin Hotel, Oklahoma City, Okla. H H Henline, secy, AIEE, 29 W 39th St, New York 18, N. Y.

Nov 2-3 — Pennsylvania Electric Assn, Prime Movers Committee, fall meeting, Benjamin Franklin Hotel, Philadelphia. E Gordon, Chairman, Potomac Edison Co, Hagerstown, Md.

Nov 27-Dec 2—American Society of Mechanical Engineers, 19th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York, N. Y. Charles F Roth, mgr. International Exposition Co, Grand Central Palace, New York, N. Y.

Air-Pollution Panel Features NAPE Meeting

► THE 49TH ANNUAL power show and convention of National Assn of Power Engineers was held in the Hotel Jefferson, St. Louis, Mo., August 15-19.

Educational feature of the meeting was a panel discussion on the national policy toward air pollution adopted by NAPE. That policy can be expressed in these basic principles: (1) Wherever possible, every air-pollution ordinance should define what constitutes a nuisance. Then set allowable limits of emission deemed practical by both equipment manufacturers and operators. (2) No ordinance should empower the enforcement agency to pass on plant design, approve equipment or select fuel since in the last analysis any pollution violation must be determined at the point of emission to the atmosphere.

This policy was presented before the following panel: H L Wagner, vice-president in charge of engineering, Detroit Stoker Co, representing the power equipment field; H B Lammers, chairman, Coal Producers Committee for Smoke Abatement, as the fuels representative; Charles Caspari, attorney for Monsanto Chemical Co, speaking for the process industries; R R Tucker, dean of mechanical engineering, Washington Univ; J H Carter, St. Louis smoke commissioner, spokesman for the enforcement agencies; J C McCabe, associate editor of POWER; T J Barrett, building supt, Waldorf-Astoria Hotel, representing NAPE.

The policy was favored with some modification by all but the enforcement representatives, R R Tucker and J H Carter. Their feeling was that the only practical way to correct air pollution was to correct it at the source. The source, Tucker felt, was the furnace and through regulation of fuel and equipment the problem would vanish.

Chief objections to this reasoning as expressed by several of the panel were: (1) Even if a given plant complied in every respect by using approved equipment, selected fuel and, as some ordinances require, met design specifications, the enforcement agency assumed no moral or legal responsibility but held the plant owner and operator responsible for violations as they developed at the stack. (2) The hands of both operator and management were tied by permitting them no leeway for

(*Continued on page* 216)

PINPOINT SKETCH OF INDUSTRY-WIDE SATISFACTION

Photo of 4' x 6' wall map of Nalco Industrial Department. Each pin locates a user of The Nalco System. Pins in Great Lakes are Nalco System ships.

NALCO System installations and ships*—each a pin in the map above—literally blanket the industrial and fresh water navigation areas of our country. The reason is simple: *satisfaction with Nalco chemicals and services.*

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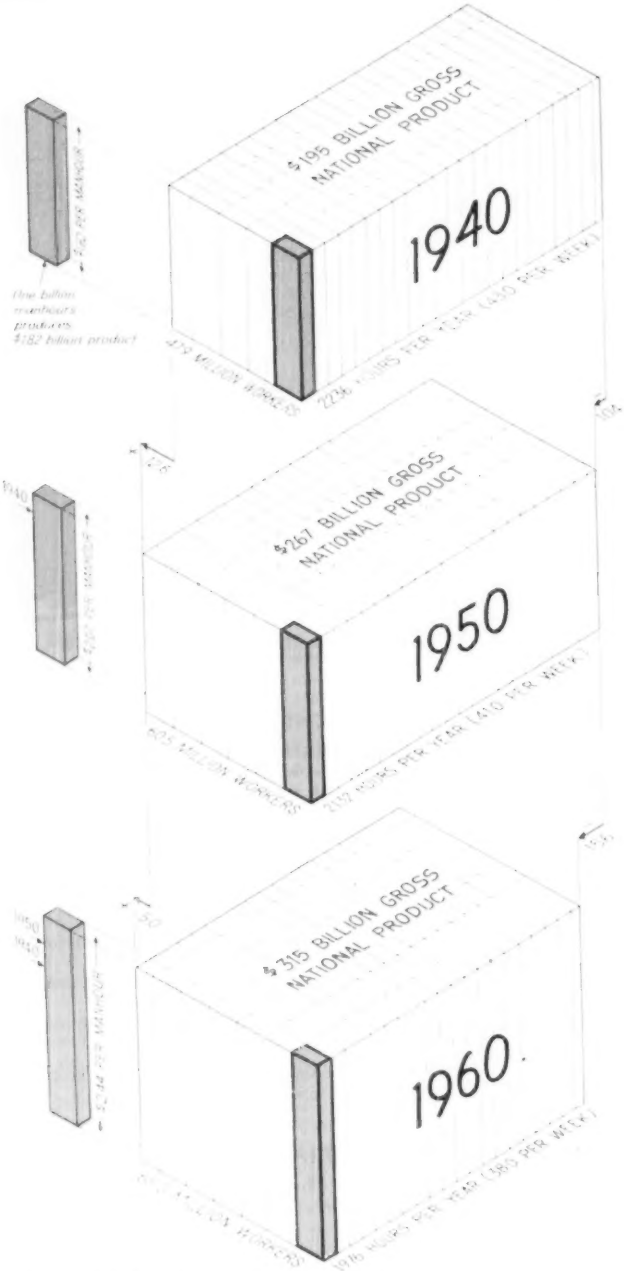
- **LABORATORY RESEARCH**, commercial analyses, consulting services.
- **PAPER AND PULP MILL** pitch and clay control, size control, slime and mold prevention.

Additional information on any Nalco Chemicals and Services will be furnished without obligation.

NATIONAL ALUMINATE CORPORATION
6222 W. 66th Place • Chicago 38, Illinois
Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario

THE Nalco SYSTEM...Serving Industry through Practical Applied Science

LET'S LOOK AHEAD TO 1960



RED BLOCK in each chart represents output of 10 million men working 100 hr each, or one billion man-hours. So 1960 red block equals $2.44 billion of goods, services

McGraw-Hill economists estimate a 10-year growth of:

- **5 million employed**
- **18% in productivity**
- **18% in total national output, despite 3-hour reduction in the work week**

► TOTAL NATIONAL OUTPUT of goods and services ("gross national product") will increase from 267 billion dollars in 1950 to about 315 billion dollars in 1960, a growth of 18%, according to a statistical study just completed by the McGraw-Hill Economics Staff. The table below, and the charts developed from the table by POWER editors, show comparative figures for the years 1940, 1950 and 1960.

GROWTH OF THE ECONOMY

	1940	*Est. 1950*	*Potential 1960*
Population (millions)	132	151.5	165
Labor force (millions)	56	64.3	69
Employed	47.9	60.5	65.5
Unemployed	8.1	3.8	3.5
Average weekly hours	43	41	38
Total man-hours worked (billions)	107	129	129.5
Output per man-hour (in 1950 dollars)	1.82	2.07	2.44
Gross national product (billions of dollars)	195	267	315

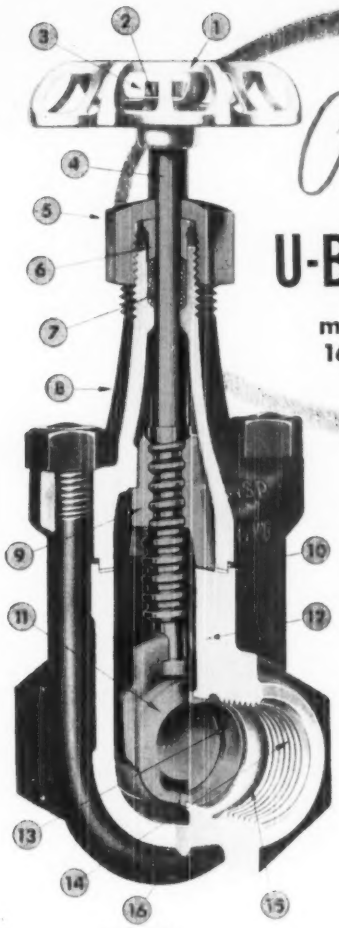
Note that gross national product is merely the arithmetical product of the number of people working times the average hours worked *per year* by the average productivity (value of product of one man working one hour). All values are in 1950 dollars to eliminate effects of inflation or deflation.

According to the study, the number of employed persons (actually working) will increase from 60.5 to 65.5 million. The work week will shorten from 41 to 38 hours. Value of one man-hour's output will increase from $2.07 to $2.44.

These figures disregard yearly ups and downs of business and refer only to average level of long-term growth curves. Experience shows that even wars don't greatly affect these long-time trends.

Only Jenkins U-BOLT GATES

measure up to this 16-point standard



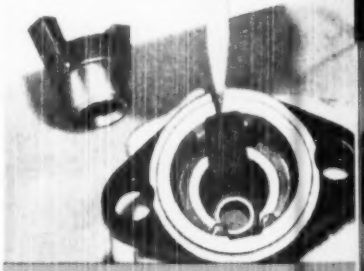
1. Perfect-Grip Handwheel
2. Valve Index Plate
3. Secure Wheel Nut
4. Heavy Manganese Bronze Spindle
5. Large Packing Nut
6. Self-centering Packing Gland
7. Deep Stuffing Box
8. Heavy Duty Bonnet
9. Unique Renewable Bonnet-Saver Bushing
10. Body-Bonnet Safety Joint
11. Extra-Wide Gauge Reversible Bronze Wedge
12. Heavy-Duty Body
13. Bronze Seat Rings, Expanded in
14. Full Length Pipe Threads
15. Liberal Diaphragm Clearance
16. Strong U-Bolt

PRESSURES

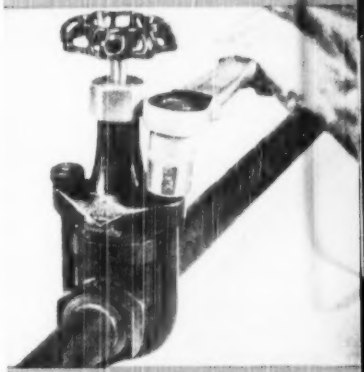
Screwed	Flanged
150 lbs. Steam	125 lbs. Steam
225 lbs. O.W.G.	175 lbs. O.W.G.

Bronze Mounted or All Iron—Sizes ¼" to 3"

BONNET SAVER BUSHING — No need to junk the bonnet when operating threads are worn. Just slip in a new, patented "Bonnet-Saver Bushing" and have good-as-new thread engagement.



EASY TO CLEAN — You can really get into the bonnet of this valve to clean out the chamber above the operating threads.



RUGGED CONSTRUCTION — Here's proof. When the U-bolt nut was tightened down with a 14" socket wrench until the high tensile steel bolt broke, the heavy duty body and bonnet did not crack!

TROUBLE IS RULED OUT! Check these 16 advanced features—for wear-resistance . . . for ease of maintenance. From handwheel to diaphragm, notice how thoroughly trouble has been ruled out in designing this U-bolt valve. No other valve in its class measures up to Jenkins U-bolt Gate on all these points, many of them exclusive.

You can take it apart and put it together again in two minutes, and it's a cinch to clean. When operating threads become worn, just slip in a new "Bonnet Saver Bushing" and restore it to new-valve efficiency. It's a favorite for those plumbing-heating, mine, mill or any services where excessive sediment is tough on valves and where freezing is a hazard.

For "renewability" without waste, bull-necked endurance, and low upkeep cost, you can't beat Jenkins U-bolt Valves. Yet they cost no more! Full details and specifications in new circular, Form 179-B. Jenkins Bros., 100 Park Avenue, New York 17. Jenkins Bros. Ltd., Montreal.

Sold through leading Industrial Distributors

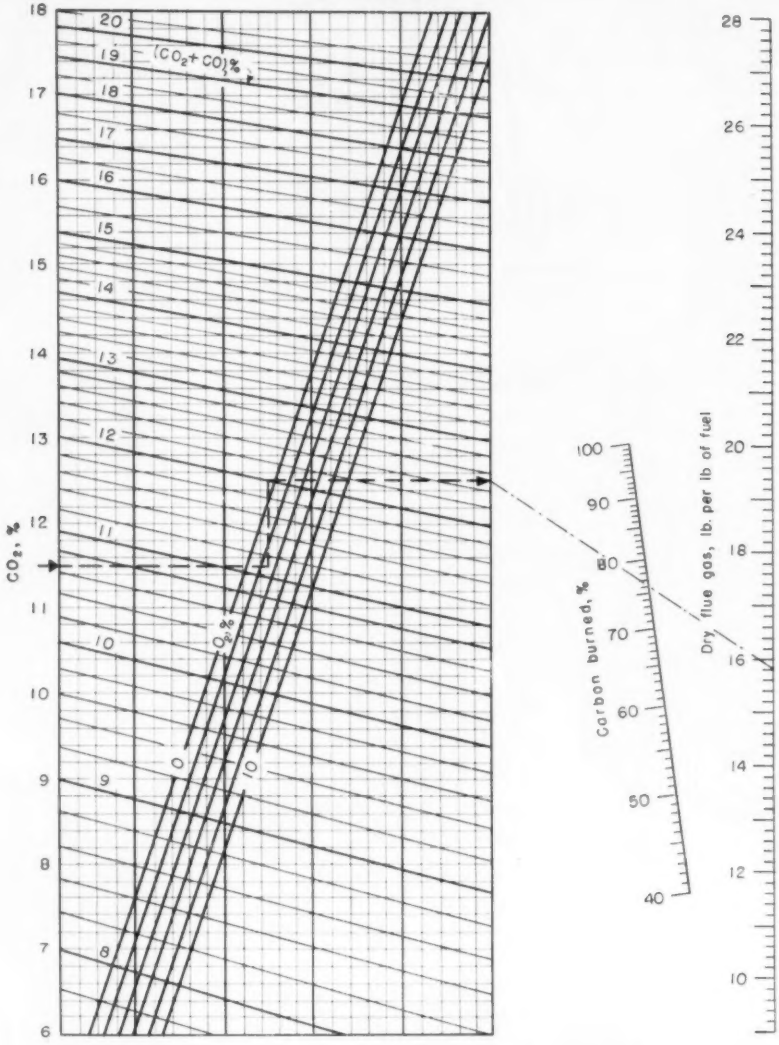
JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros

Number 220



Weight of Dry Gas Per Pound of Fuel Burned

► KNOWING THE POUNDS of carbon burned per pound of fuel and the complete flue-gas analysis, you will be able, with the aid of this chart, to figure the weight of dry flue gas per pound of fuel. The chart is based on the formula:

$$W = C \times \frac{11CO_2 + 28CO + 28N_2 + 32O_2}{12(CO_2 + CO)}$$

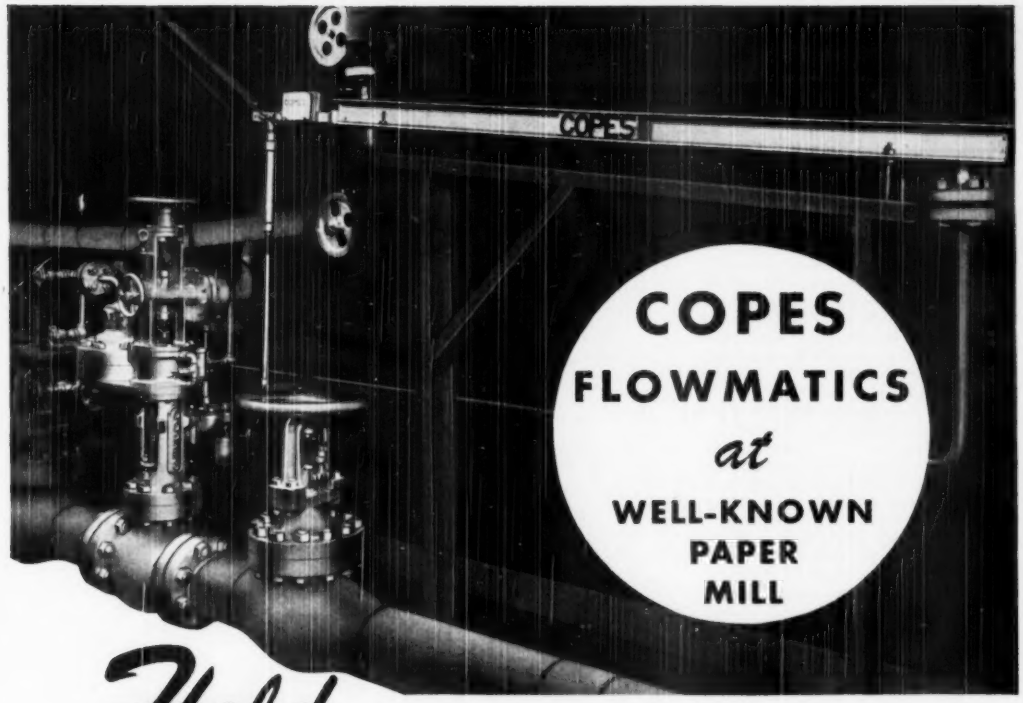
Let's run through a problem.

Example: From ultimate analysis of a coal and the combustible in refuse we found 0.76 lb carbon per lb coal was burned, or 76% of the fuel weight. The orsat analysis of the flue gas gives 11.5% CO_2, 3% O_2 and 0.5 CO.

To find weight of flue gas, find 11.5% CO_2 on the left-hand scale of the chart. Follow horizontal line to intersect with 3% O_2 inclined line. From here follow vertical graduations to intersect with 12% $(CO_2 + CO)$, inclined line. Then follow horizontal graduation to right-hand edge of grid. From here lay a straightedge to intersect with 76% carbon burned on center scale. Read answer at intersection on right-hand scale as 15.8 lb dry flue gas per lb of fuel.

You can solve the equation much quicker with the chart than with the original basic equation.

JOHN F HYAM *Sarnia, Ont.*



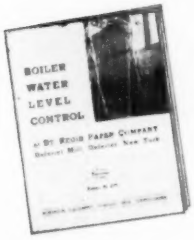
Hold CLOSE WATER LEVEL on fast-steaming boilers taking rapid swings

Here is one of two COPES Flowmatics serving 810-psi, 825-F C-E Type VU boilers in one of New York State's most modern paper mills. Rated at 110,000 pounds per hour, each boiler is subject to a sharp load change every three minutes. Despite this severe service, drum water level is held within plus-or-minus one inch.

NORTHERN EQUIPMENT COMPANY

1010 Grove Drive, Erie, Pennsylvania

BRANCH PLANTS in Canada, England, France, Austria, Italy • *Representatives Everywhere*



The story of this important installation is told in Performance Report Bulletin 479. Write—on your letterhead, please—for your copy.

COPES

COPES

Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

PLANT EQUIPMENT NEWS

Published monthly as a service to readers

Your information center for new products to solve plant problems. Spot what you need, use handy cards p 190a, to get more details

ELEVATOR VACUUM CLEANING KIT P1099

Designed to simplify and reduce labor and cost of cleaning elevator cars, hoistways and machine-room equipment, this kit consists of a powerful portable vacuum cleaner with two 10-ft lengths of oil-resistant vacuum hose, a 16-in. length of flexible tool hose and a set of 18 tools for practically every kind of cleaning job in elevator hoistway and machine room.

A special tool has a nozzle that seals around the guide rails. With this tool and the vacuum machine a car or counterweight guide rail can be cleaned at slow car speed from top to bottom of hoistway without a stop and without scattering dirt on other equipment.

Vacuum brushes and other tools are available for cleaning hoistway and car walls and counterweight surfaces. Whiskers, fuzz and dust, collected by vacuum, are not thrown into the air to lodge on other parts. When car-operating schedules permit, cleaning can be done during off-peak day periods in one hoistway by the regular day-maintenance crew and not stop operation of cars in adjoining hoistways.

Oily and greasy surfaces must be washed clean with solvent, but this job is made easier after removal of all loose dirt by vacuum. Where guide rails are operated dry, once they and outside of car are thoroughly cleaned, a periodic application of the vacuum equipment keeps these surfaces free of dust and dirt, practically eliminating the fire hazard.

The machine-room equipment is cleaned like hoistways and cars. With special tools designed for the job and the powerful vacuum machine, dirt and dust are removed from even remote recesses in the equipment, without permitting it to get into the air to lodge on other machines.

As a safety precaution and convenience for the cleaning crew a carryall tool bag is designed to suspend from the hoist ropes connected to the car's crosshead, during cleaning. This bag keeps all tools safely within easy reach. Fitted with a pocket to hold each tool the danger is greatly reduced of tools falling from car top down the hoistway during cleaning. Also, tools are not misplaced after cleaning is completed. Catalogs available.

Lehara Sales Corp. 485-5th Ave, New York 17, N. Y.

PIPE INSULATION P1047

Calcium-silicate pipe insulation, for use up to 1200 F, is made to simplified dimensional standards. One piece of covering can be fitted over another. Outside diameter of each piece is same as that of a pipe.

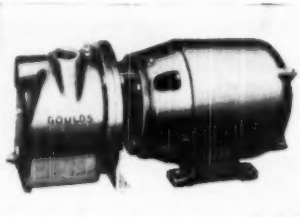
Kaylo pipe insulation in ¾- to 12-in. sizes comes in half sections; from 12 through 20 in., it is made in three sections; from 20 to 36 in., in four sections. For larger sizes, curved blocks, 18 in. wide and 1½ to 4 in. thick, are available for pipes up to 72-in. diameter.

Owens-Illinois Glass Co, Toledo, Ohio

ROOF VENTILATORS P1046

Motor-driven vertical-discharge roof ventilators are designed for exhausting air from machine shops, foundries and other industrial buildings where fumes must be discharged into air as high as possible above roof. Available with fan wheels 36, 42 and 48 in. in diameter, capacities up to 40,900 cfm. Units are weather-proof at all times.

DeBothezat Fans Div, American Machine & Metals, Inc, East Moline, Ill.



SELF-PRIMING PUMPS P1003

Centrifugal pumps are self-priming without recirculation of water during pumping at efficiencies comparable to standard pumps. Built in sizes from ¼ to 5 hp, with either open or closed impellers for capacities to 120 gpm and heads to 135 ft depending on capacity. Suction lifts range up to 25 ft. Bulletin 636.1.

Goulds Pumps, Inc, Seneca Falls, N.Y.

DIESEL ENGINES P1009

Series of heavy-duty 4-cycle diesel engines, have 3, 4 and 6 cylinder with 8-in. bore and 10-in. stroke, for horsepower rating from 68 to 240 at 450 to 750 rpm. Engines are enclosed but accessories are mounted for easy servicing. Removable inspection covers allow routine inspection without loss of operating time.

Cooling systems with radiators, cooling towers or evaporative coolers are available as optional equipment. Engine's structural-steel base may be extended for mounting radiators and driven equipment, making a compact, self-contained unit, portable if desired. Generator sets for dc

For further data on above items use reply cards on page 190a, identifying your request with letter P and number

doing this *costs more* now!

You do it less often

by using Dependable Quality

CRANE VALVES

That's why more Crane Valves are used than any other make

. . . this valve likes tough throttling jobs

—And for durable, maintenance-free service, it's typical Crane quality. The plug-type disc and seat construction in Crane No. 14½P's utilizes the toughest combination of metals found in 150-Pound brass valves. Extra wide seating surfaces give high resistance to damage by "wire drawing" or foreign matter. Crane disc taper is precisely correct for accurate flow regulation.

Whether you need throttling valves or any other type, you'll pay less in the long run by insisting on Crane Quality. Get a demonstration by your Crane Representative.

CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

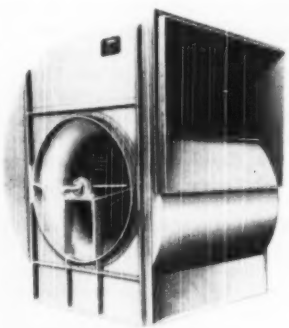
EQUIPMENT NEWS *CONTINUED*

or ac are available for standby power supply for industrial plants. Bulletin No. M-16. **Enterprise Engine & Machinery Co, 18th and Florida St, San Francisco 10, Calif.**

SMOKE ALARM P1001

Assembly has a lamp unit and an alarm unit supported on a 1-in. pipe on opposite sides of stack or breeching. Lamp is a standard 75-w 120-v reflector spotlight mounted in a steel casing. It does not require focusing or a visor, thus reducing installation time and maintenance. A built-in resistor increases lamp life up to 100%. Standard lamp units are satisfactory on breechings as they have minimum width of 2½ ft and maximum of 7 ft.

Smoke density to comply with local regulations may be selected by an adjustment knob on bottom of casing. This adjustment is also used to compensate for dust or dirt that collects on the face of lamp or alarm unit. When smoke density reaches the selected value the alarm rings and continues to do so until density is reduced below the legal limit. Failure of lamp or phototube causes alarm to sound. **General Power Plant Corp, 331-4th Ave, New York 16, N. Y.**



VENTILATING AND INDUSTRIAL FANS P1048

Primarily for air-conditioning, ventilating, industrial process and power applications, this line of fans has forward-curved backward-inclined units. Forward-curved fans are built in 21 sizes from 12- to 89-in.-wheel diameters. Backward-inclined units are in 23 sizes from 12- to 109-in.-wheel diameters. Each size is available in single and double widths and in both Class I and II construction. Line includes all standard motor and drive arrangements and discharge-outlet directions.

All fans are finished with a corrosion-resistant coating of chlorinated rubber-base enamel. For special corrosive conditions in industrial applications, fans are coated with zinc, lead, rubber, neoprene or a phenolic resin. They can also be fabricated of aluminum, copper, monel or stainless steel. **The Trane Co, La Crosse, Wis.**

HEAT-PRESSURE TRAP P1056

Pressure opens discharge valve of this trap. Heat, acting on a bimetal, closes discharge valve. Strainer is integral in all units. No air valve is used; discharge valve permits flow of air into condensate line. Discharge valve also acts as check valve to prevent reverse flow through trap. Trap can be mounted in any position and is fitted with a sight glass for observing operation.

Only one orifice size is used in trap. It is a ½-in. dia orifice and has a capacity equal to that in usual 2-in. trap. Trap is frost-proof and solidification proof.

Two sizes are available, the *Junior* and *Universal*. Range of each is adjustable. **Velan Engrg Co, 1216 Drummond St, Montreal, Canada**

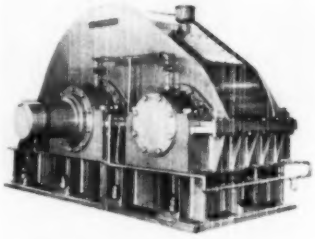
PACKLESS REDUCING AND REGULATING VALVES P1044

Available in sizes up to 3 in. with packless main stem, reducing valve may be pilot or direct operated. Valve is single-seated positive dead-end unit. External dimensions of packless valves are same as for packed valves. **The C E Squires Co, 18502 Syracuse Ave, Cleveland 10, Ohio**

HIGH-DENSITY WELDING P1018

New welding process, *Hidensity*, employs welding-current densities on 5/64-in. wire, which melts the electrode at speeds comparable to 10,000 amp on standard 5/16-in.-dia coated hand electrode. This process can be used on the company's standard SAE 600 or SAE 900 welding generator, or any SAE 600 gasoline engine-driven generator.

Use either a 3/32- or a 5/64-in.-dia electrode under welding currents up to 600 amp. Because of the small electrode diameter, current densities are high and produce a deep penetrating arc, which allows high welding speeds. An ML-2, manual Lincoln-weld unit, can be connected in a matter of minutes to the generator. It amounts to an automatic head and is completely self-contained. **Lincoln Electric Co, Cleveland 1, Ohio**

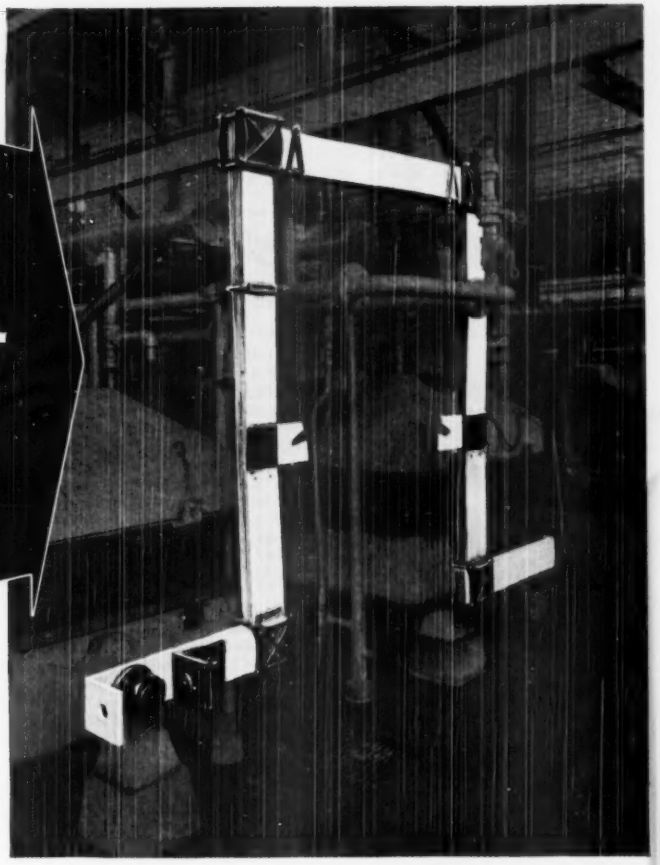


INDUSTRIAL SPEED REDUCERS P1005

Single- and double-reduction industrial speed reducers in ratings up to about 3000 hp. They have taper-hardened gearing and pinion shafts, and fabricated steel housings. Gearing is standard AGMA

For further data on above items use reply cards on page 190a, identifying your request with letter P and number

HIGH efficiency at LOW voltage



Revere Copper is the ideal commercial metal where low voltage D.C. must be conducted at high efficiency.

• Type S, the large Hooker Electrolytic Caustic-Chlorine Cells, operate 24 hours a day 365 days a year at very high current efficiency under average operating conditions.

In the plant of the Hooker Electrochemical Company, at Niagara Falls, N. Y., the current for these cells enters as high voltage A.C. and is converted to low voltage D.C. in mercury arc rectifiers. Revere Copper Bus Bar carries the D.C. current from the mercury arc rectifiers to the Caustic Chlorine Cells. In these high voltage circuits efficiency is promoted by the ability of electrolytic copper to conduct current with the lowest losses possible for any commercial metal. Copper also is the best dissipator of the heat which accompanies high voltage A.C. conduction.

Current of 10,000 amperes from the rectifiers produces a voltage drop of 3.75 per cell. Here any increase in the resistance of the material of which the bus bars are made must result in a corresponding decrease of the efficiency of the circuit.

That is why Revere Electrolytic Copper Bus Bars are used. They have low resistance and high efficiency.

When an anode is to be renewed the cell is short circuited by means of a portable jumper which consists of copper connections and a switch, thus flowing the entire current around the cell and avoiding interruptions of the circuit.

This is an example of the all around handiness of Revere Copper for handling electricity. Copper has ideal mechanical strengths or "physicals" for clamping or bolting, and the best surface for high efficiency connections.

For low voltage or high, make your next installation with Revere Copper Bus Bar. You will get more results from your power dollar.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

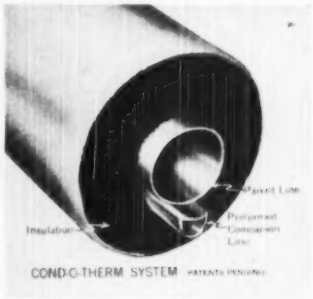
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif., New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

EQUIPMENT NEWS *CONTINUED*

hobbed double-helical with a high helix angle for smoother operation and low vibration at higher speeds. This type gearing reduces thrust against either case walls or bearings, and assures uniform tooth loading and wear.

Antifriction bearings are lubricated by a simple splash system. Housings are fabricated of rolled-steel sections, which form box-type bases. Wide-flange I-beams, interlocked and welded, provides rigidity.

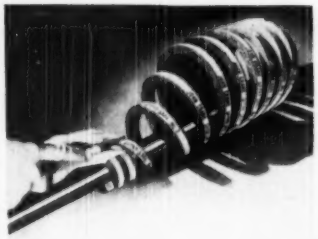
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.



PROCESS TEMPERATURE P1025

A preformed, extended companion line with substantial surface-area contact on parent line carries accurate temperature information on temperature of any insulated process line. Parent line can be welded, sweated or flanged construction. One end of each companion-line length has special extruded neck to provide a slip fit over end of next lengths so the joints may be brazed or silver-soldered in assembly.

Cond-O Therm, 18 Littleton Ave, Newark, N. J.



PLASTIC PACKING P1031

Securely vulcanized tape-back has been made an integral part of *Super-Seal* plastic packing. It increases packing flexibility and now brings plastic packing into easy-to-handle class of ordinary braided fabric. Ring cutting is greatly simplified.

Super-Seal comes in six styles. They are extremely resilient and homogeneous, and are composed of asbestos, anti-frictional metal particles, flake graphite and special binders.

Crane Packing Co, Dept Q-22, 1800 Cuyler Avenue, Chicago 13, Ill.

LIQUID-LEVEL CONTROL P1004

Installed at pump sites, these controls automatically operate pumps by pressure changes at predetermined high and low tank-water levels. Two bellows are used, one for high-level and one for low-level control. Each need expand or contract only a few thousandths of an inch to start or stop pump.

As water level recedes in tank, pressure drops on the twin bellows. When level reaches the low setting, low-level bellows after a time delay starts the water pump. As water level rises, pressure on the bellows increases. When level reaches the high setting, high-control bellows stops the pump.

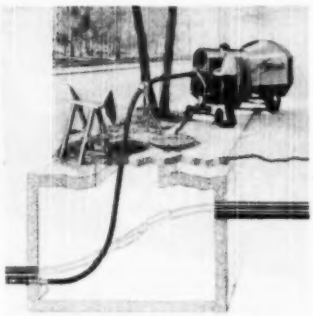
Automatic Control Co, 1005 University Ave, St. Paul 4, Minn.

PISTON-OPERATED CONTROL VALVES P1039

Adapted to confined spaces where ordinary control valves would not fit, these piston-operated units can control low-pressure steam or hot or cold water. They are available in ½- and ¾-in. pipe sizes with union-angle and union-globe patterns, reverse flow, double-union angle and female-union inlet-globe bodies.

In water valves, water pressure gives positive seal with V-ring packing. Molded split-ring packing is used for low-pressure steam service.

Johnson Service Co, 507 E Michigan St, Milwaukee 2, Wis.



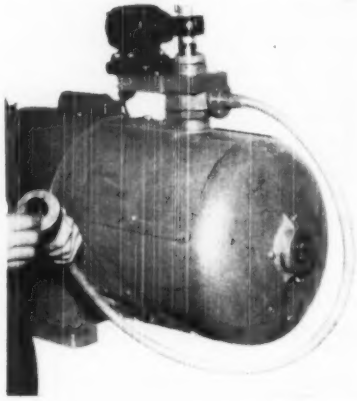
DUCT RODDER P1080

Flexible *Roducter* pushes, pulls and rotates flexible-steel rods and ducts, speeding up installation of electric cable. It works at speeds up to 100 fpm, and rods 900 ft in one direction from one location.

Flexible Sewer Rod Equipment Co, 9059 Venice Blvd, Los Angeles 34, Calif.

REGULATOR FILTER P1040

Cono Airpack is a reducing-relief valve and air filter under one cover. It is suitable



PRESET MOTOR-SPEED DEVICE P1090

The *ACA* motor (ac adjustable speed) is now available with a mechanical control for getting a preset speed without using expensive control equipment. New device enables a predetermined speed to be set manually by a knob either directly on the *ACA* motor or at the end of flexible cable 10 or 15 ft away.

Speed adjustment may be made while motor is at a standstill or running. Speed control is obtained by rotating brushes around the commutator. Since speed is a function of brush position, any device that automatically brings the brushes to an adjustable predetermined position serves the purpose.

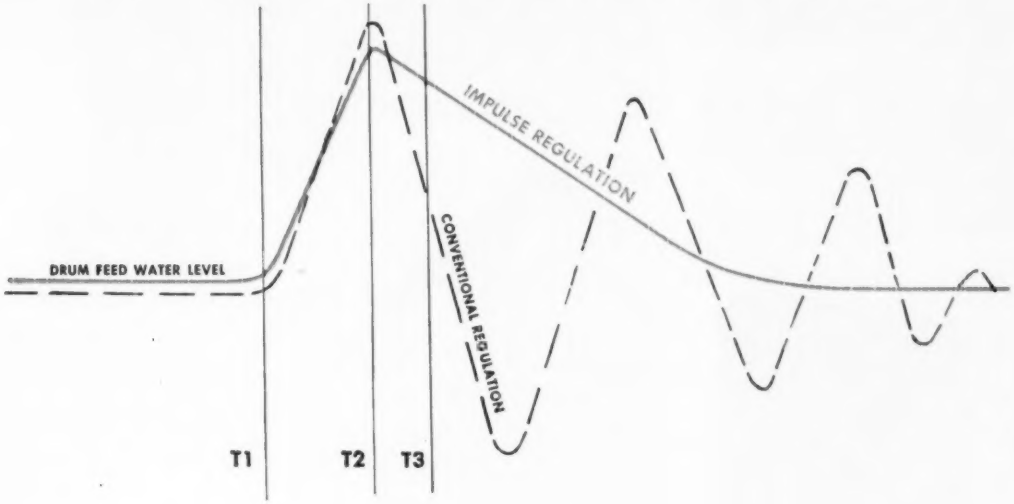
The new mechanism operates a pilot motor, which in turn drives the brushes to a position corresponding to the speed setting. A stop or automatic slow-down returns the brushes to the lowest-speed position without disturbing the original setting. When the *ACA* motor is restarted, the brushes again come back to the preselected speed without any attention from operator.

Some applications for this motor would be new brush-shifting device and offset printing presses, planer-speed-roll drives, conveyor drives, ball mills, etc.

General Electric Co, Schenectady 5, N. Y.

For further data on above items use reply cards on page 190a, identifying your request with letter *P* and number

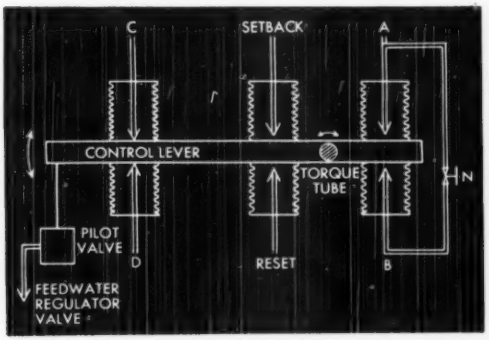
Control feed water level accurately during QUICK load change T_1T_2 with IMPULSE regulation



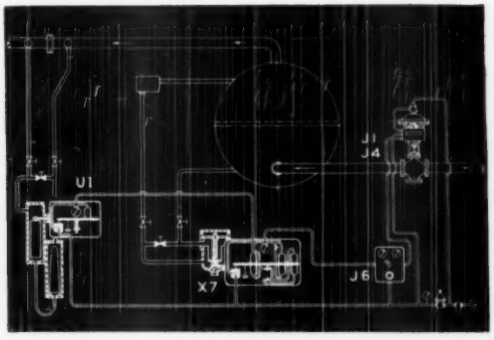
1 **COMPARE** that solid red line with the s-u-r-g-i-n-g feed water level represented by the dotted black line. Trouble is that conventional two-element systems, once adjusted for a given rate of change T_1T_3, merely react to magnitude of steam load without being able to compensate for a *different rate of change in load* T_1T_2. Since "shrink and swell" and resulting false drum level are functions of rate of change as well as magnitude of load, only Swartwout impulse regulation acts instantly and positively for *any rate of change in load* of any magnitude.

Swartwout

POWER PLANT EQUIPMENT



2 **DIFFERENTIAL LEVEL AND IMPULSE CONTROL** has setback bellows for wide throttling range and stability; reset bellows for constant level regardless of load. Bellows A, B and needle valve N, which comprise the impulse unit, convert air pressure proportional to load magnitude into an impulse reflecting *rate of change* as well as magnitude of load. This impulse cancels out drum "shrink and swell" effect (transmitted by torque tube) which is also based on rate of change and magnitude of load. Adjustment for varying water level with load is effected by bellows C, D if desired.



3 **SQUARE ROOT** of steam line orifice differential is taken by U1 flow transmitter which feeds air loading pressure proportional to steam flow into X7 differential level and impulse control. Regulating valve is equipped with J1 Positioneer and J4 air lock. J6 panel shows intermediate and manual pressures, provides for manual and automatic operation. In addition to this FW6 two-element impulse system, Swartwout also makes an FW7 three-element impulse feed water regulating system. Other types include the FW5 single-element system and SC (FW1) thermo-hydraulic system.

SEND FOR BULLETINS S-27, S-20-E. THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

EQUIPMENT NEWS *CONTINUED*

for automatic-control instruments, gaging equipment, packaging machines, air brushes and other equipment using air. Capacity averages about 25 cfm. Either horizontal or vertical mounting.

Filter medium is phenolic resin impregnated cellulose. It can remove oil and water particles down to 40 microns. Three ¼-in. taps permit multiple reduced-pressure connections and pressure-gage mounting. *Airpak* is available in reduced-pressure ranges of 0-25, 0-50 and 0-125 psig.

Conoflow Corp, 2100 Arch St, Philadelphia 3, Pa.

PLUG-IN CONTROL P1057

Circuit breakers, starters and switches are incorporated in this control center. Up to six starters can be mounted in a standard vertical section 20x20x90 in.

Plug-in units have positive-pressure stabs that grip round vertical busses. Units slide on corner guide rails to make removal or exchange quick and easy.

Square D Co, 4041 North Richards St, Milwaukee 12, Wis.

SEALED INSTRUMENT P1058

This compact instrument has a depth of 1⅝ in. from front of panel and is 4½ in. in diameter. A zero adjuster may be moved without breaking hermetic seal.

Instrument is available with either 1 or 2% accuracy rating. Dials are standard or specially calibrated depending upon requirements.

Marion Electrical Instrument Co, Manchester, N. H.

TANK-HEATING NOZZLES P1045

Designed for heating liquids in tanks, *Sparger* nozzles discharge steam at high velocity into liquid. Circulation is set up in tank by entrainment of liquid in nozzle. Constant agitation is maintained in tank.

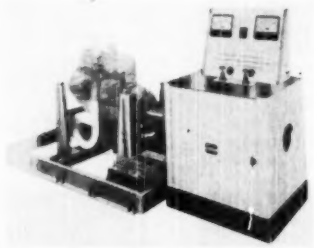
In bronze, cast iron, stainless steel and Haveg, nozzles are suitable for corrosive and other liquids. One nozzle in a 100-gal tank circulates 20 gpm of water and raises liquid temperature 40 F in 11 minutes when supplied with 183 lb per hr of steam at 40 psig.

Schutte & Koerting Co, 12th and Thompson Sts, Philadelphia 22, Pa.

ELECTRODE HOLDER P1059

Insulated, light-weight electrode holder the 6J-1, 250-amp size for 1/16 to 3/16 in. electrodes, contains the advantages of both tong and hole-type holders. Tip of jaw end is covered with a high-temperature resistant, highly flexible asbestos-base compound.

Lincoln Electric Co, Cleveland 1, Ohio.



ENGINE DYNAMOMETER P1092

Incorporating direct reading, electric speed and horsepower instruments, this line of dynamometers operates with machine horsepower ratings from 50 to 2000 at many different speeds. Machines can be adapted to needs of gasoline- and diesel-engine rebuilders, as well as in the electric motor field. Loads may be increased or decreased and then re-established without sacrificing accuracy.

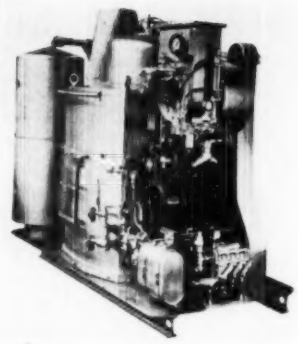
Clayton Mfg Co, El Monte, Calif.

PIPE CUTTER P1034

Lightweight 185-lb power tool. Economy Model E pipe-and-bolt machine cuts and threads pipe, bolts and conduit. It has capacity up to 8 in., and is fed by a lever.

Model E uses the same die heads, dies, interchangeable wheel-and-roller or knife cutoff devices, the same reamer arm and cone as Models A and B. This permits the shops now equipped with A or B to save cost of duplicate dies and parts.

Beaver Pipe Tools, Inc, Warren, Ohio



PORTABLE STEAMER P1017

Portable steam generator, Model 4635, can develop up to 200-psi working steam pressure from a cold start. Unit develops as much as 3500 lb of steam per hr at any pressure from 75 to 300 psi. Hot gas from a forced-draft oil burner passes over a 575-ft steel coil where the steam is generated.

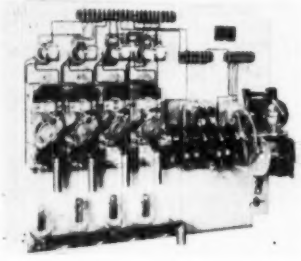
Among its new features are (1) economizer coil in path of exhaust gas (2) relocated motor that drives water pump, blower and fuel pump and shortens unit's over-all length (3) larger combustion space (4) higher working steam pressure of steam reservoir to 250 psi. Over-all dimensions are 8 ft long, 4 ft wide, 6½ ft high.

Vapor Heating Corp, 80 E Jackson Blvd, Chicago 4, Ill.

UNIT HEATER P1026

New suspended, blower-type unit heater, the US-B, is modification of the recently released fan unit with propeller fan replaced by a centrifugal blower. US-B comes in eight sizes with belt drive on large heaters and direct drive on the 50,000 and 25,000 Btu sizes.

Reznor Mfg Co, Mercer, Pa.



PUMP CONTROL P1023

Automatic control can be had with the Pressureflo. It consists of a flow-determining means, a pressure or level sensing device and a mechanism to translate this information into a control function.

Device may be used to start and stop

(Continued on page 152)

For further data on above items use reply cards on page 190a, identifying your request with letter P and number

What do we mean... DOWELL SERVICE?

Service is something you can't see, smell or touch. You can't pick it up, inspect it, test it and say, "This is good service." No—when you buy service you buy certain intangibles that are your insurance of good performance—good service. What are these intangibles? Knowledge, experience, dependability—those are the things you buy . . . the things that Dowell sells.

Dowell is a *service* organization . . . specialists in the chemical cleaning of boilers, heat exchange equipment, lines and piping, water wells and other types of industrial equipment. A subsidiary of The Dow Chemical Company, Dowell exists only to serve—to bring to industry, through its service organization, the applied benefits of chemical discoveries. All the research at Dowell and at The Dow Chemical Company is good research only if it helps you. Dowell men are trained in that concept—Dowell equipment is designed for that purpose. It's not just the physical doing of another job, but rather the active desire to put the things that research discovers to work serving you. It is this sincere wish to help that has given Dowell the knowledge, experience and dependability that are back of every job.

Perhaps you have a problem Dowell can solve. We'd like to try. Plants in many industries have found it profitable to use Dowell Service for preventive and regular maintenance cleaning. That's Dowell Service—chemistry at work for you. Call Dowell today.

Specialists in the use of chemicals to remove deposits

from steam generators, condensers, heat exchangers, cooling jackets, water wells, water and product lines, gas washers, filters, towers and other industrial equipment.

CALL

DOWELL INCORPORATED TULSA 3, OKLAHOMA

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

New York 20	Cleveland 13	Wichita 2	Hamilton, Ohio
Boston 16	Pittsburgh 19	Oklahoma City 2	Charleston 27, W. Va.
Philadelphia 2	Detroit 2	Houston 2	Salem, Illinois
Baltimore 18	Chicago 2	New Orleans 12	Borger, Texas
Wilmington 99	St. Louis 8	Ft. Worth 2	Midland, Texas
Richmond 19	Indianapolis	Shreveport 69	Wichita Falls, Texas
Atlanta	Louisville	Anniston, Alabama	Lafayette, La.
Buffalo 2	Kansas City 8	Mt. Pleasant, Mich.	

Long Beach, Oakland, Casper: Dowell Associate—International Cementers, Inc.

DOWELL

A SERVICE ORGANIZATION

Put This Feather in Your Cap

Here it is October again—the Red Feather month when the Community Chests of America make their annual plea for funds. This is one time I don't mind digging down—for three reasons: As a man, as a taxpayer and as an engineer.

As a man, I'm going to give because some of the more than five thousand health and welfare agencies that will benefit from this drive have already helped me more than once and probably will again.

Probably the same goes for you and your family, too. The Scouts, YMCA, Travelers Aid, hospitals, visiting nurses, etc, all have played some part in most of our lives. These people need money and lots of it to operate.

As a taxpayer, I'm going to give because, without such worthy organizations as the Salvation Army, legal aid societies and neighborhood houses to care for the unfortunate, our government would have to step in. It would cost us a whale of a lot in taxes, much more than these organizations need now. And with its red-tape methods I don't think the government could do as well.

And as an engineer, I'm going to give because, in addition to the above reasons, I respect efficiency. I like the way the whole thing is handled. Millions of dollars and hours are saved by raising money for all these organizations at one time. Furthermore, I know that almost every last penny I give will go right to the people that need it with no large chunks diverted to professional fund raisers. This is one appeal that's strictly above board.

I could name many more reasons why I'm going to give. And if you think it over, you'll find many reasons why you should give, too. A lot of very important men are giving much of their time to this Red Feather campaign. National campaign chairman is Charles E Wilson, president of General Electric. Some of the vice-chairmen are Charles E Wilson, president of General Motors, Philip Murray of the CIO and William Green of AFL. You can bet your bottom dollar that these men aren't guessing wrong when they throw their weight into this campaign.

Nobody will take that bet anyhow, so you might as well give that dollar and as many more as you can spare to your community chest. Most of the money you give stays right in your home town to help neighbors—maybe even you.

The Community Chests of America need 190 million dollars. You can figure what your share is. The funny thing is that, if you ever get in a jam, you'll probably get back more from these worthy agencies than you give. Put that feather in your cap and wear it proudly.

George Edwards

Engineer

PROTECT YOUR TURBINES THIS BETTER WAY

Lubricate with Texaco Regal Oils (R&O) and assure freedom from rust, sludge and foam

AIR and water are bound to get into turbine oil. When ordinary oils are used, oxidation speeds up, rust and sludge are likely to form—particularly if the oil has a tendency to foam. To avoid these trouble-makers, use *Texaco Regal Oils (R&O)*.

In making the world-famous *Texaco Regal Oils (R&O)*, the choicest base stocks are first refined into top-quality straight mineral turbine oils; then further improved by additives to inhibit rust and oxidation, and specially processed to prevent foaming. This extra care pays off in extra protection for your turbines.

Texaco Regal Oils (R&O) keep lubricating systems clean, free of rust and sludge... assuring normal bearing temperatures and instantly responsive governor action. *Texaco Regal Oils (R&O)* meet the exacting requirements of all leading turbine builders, and have an extra long service life.

Let a Texaco Lubrication Engineer show you specifically how your turbines and auxiliaries can benefit from the use of Texaco products. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 E. 42nd St., New York 17, N.Y.

TEXACO

TEXACO Regal Oils (R&O)

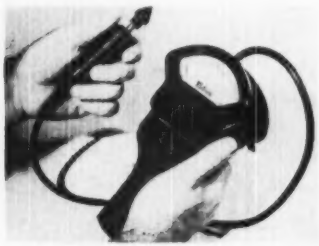
FOR ALL TURBINES

TUNE IN... TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

EQUIPMENT NEWS

(*Continued from page* 148)

pumps, increase or decrease the speed of one or more pumps, maintain a predetermined pressure at any point on a distribution system, or automatically adjust both pressure and flow to suit demands.
Builders-Providence, Inc, 345 Harris Ave, Providence 1, R. I.

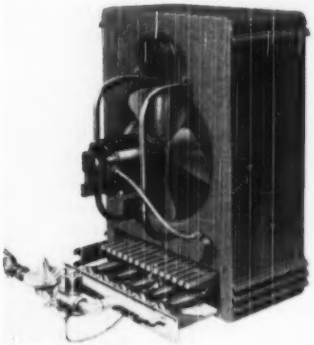


ELECTRIC TACHOMETER P1079

Type 25D hand tachometer with speed ranges of 100-1000, 200-2000, and 500-5000 rpm and fpm. Additional ranges of 10-100, 20-200, and 50-500 fpm are also available. Range-extending adapters are available to measure speeds down to 20 rpm and as high as 50,000 rpm, for special applications.
Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.

LIGHTWEIGHT LADDER P1028

Aluminum, dual-purpose ladder is constructed to serve both as 10-foot straight ladder and standard 6-foot stepladder. It weighs less than 15 lb yet each step can safely support more than 600 lb.
Original Products Co, PO Box 9155, Fort Worth 7, Texas



UNIT HEATER P1032

Drawer-type heat generator in new gas-fired unit heater burns either natural, manufactured, mixed or liquid petroleum gas. It has burner heads and mixing tubes of one-piece cast-iron construction with burners, pilot and control valves all in the drawer assembly. No gaskets are used.

Heart of the heater is the Torrid Tube heat exchanger. Its steel tubes are rolled into heavy end sheets, boiler tube style, and fortified with additional outer and inner rolled flanges. Unit is produced in seven sizes with capacities from 50,000 to 210,000 Btu per hr input and 700 to 2700 cfm.
Trane Co, La Crosse, Wis.

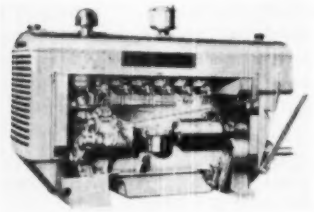
SANITARY MOTOR P1073

Screened, splashproof Type CP sanitary motor is equipped with screened ends with openings beneath the motor frame. Screened vents allow full ventilation in this 3- to 7½-hp series.
U. S. Electrical Motors, Inc, 200 E Slauson Ave, Los Angeles 54, Calif.

BOLT DIE P1021

New bolt die, the *Ridgid* OOR-B, consisting of a ratchet drive ring and handle, with ten die heads fitted with ¾ to 1 in. button dies, is now available, in both National Coarse and National Fine Thread dies.

No adjustment is said to be necessary for standard threads and easy adjustments fit the tool for undersize or oversize threads. These die heads fit the already released OOR pipe threader die ring and those who now own the OOR may purchase the bolt-head dies alone.
Ridge Tool Co, Elyria, Ohio



INTERCHANGEABLE ENGINES P1042

Portable industrial engines are built in three basic sizes as diesels, gasoline, butane or natural-gas engines. They have about same output ratings, size for size, whether

(*Continued on page* 168)

Thumb Back a Few Pages And Check These, Too ...

Water Softener where demand is less than 100 gpm ..... p 168

Electric Boiler has maximum working pressure of 50 psi. Unit is available in standard sizes from about 105 to 875 lb per hr ..... p 168

Packless Steam Trap available in six sizes with capacities from 1050 to 15,000 lb per hr ..... p 170

Pipeline-Noise Absorber is a section of rubber pipe that connects between system piping and pump ..... p 172

Semi-Metallic Packing for steam, gasoline and oil valves for temperatures to 350 F and pressures to 125 psi p 174

Ground Tester instrument gives sufficient information to tell if resistance to earth of man-made grounds is sufficiently low ..... p 176

Floor Hardener liquid is flushed over concrete floors. In filling the pores it forms a hard, glasslike surface ..... p 176

Probe Vibroscope is a hand instrument to test for vibration in turbines, generators, motors, etc. ..... p 180

Industrial Heater in 100,000 and 200,000 Btu per hr output either gas or oil firing. Units may be floor mounted, or suspended horizontally ..... p 180

Gas Mask With Phone rig allows direct telephone conversation between wearers of gas masks. Units are powered solely by the speakers' voice p 180

Heavy-Duty Floodlight is a 250-watt job designed for applications calling for a rugged unit and a narrow beam spread ..... p 182

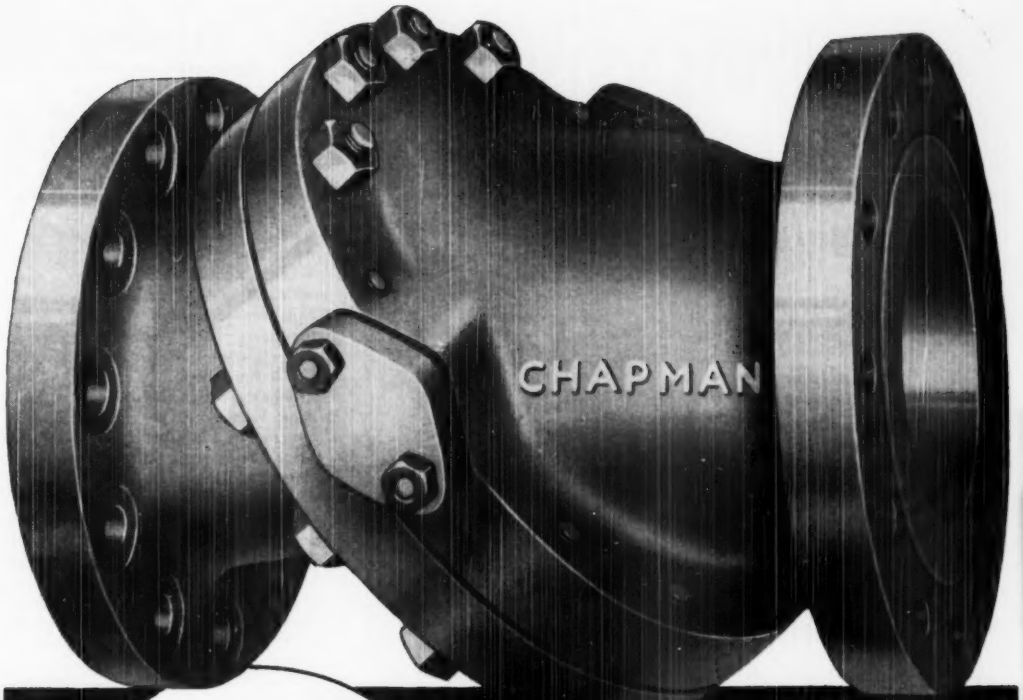
And Next Month ...

Reciprocating Pump with reduced volume between valves to increase volumetric efficiency. Fluid end is sectionalized in separate units. Each individual fluid-end section can be replaced at a fraction of cost of entire fluid-end unit.

WELDING GROUND-CLAMP P1060

Lightweight, low-cost ground clamp, the GC-3, weighs only 1½ lb, has a jaw spread of 3 inches. It can be used to give a readily movable yet solid ground for jobs where welding currents do not exceed 300 amps.
Lincoln Electric Co, 12818 Coit Rd, Cleveland 1, Ohio.

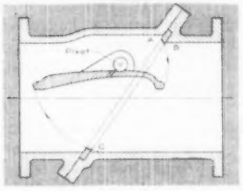
For further data on above items use reply cards on page 190a, identifying your request with letter P and number



STOP Destructive Pipe-Line Stresses

with CHAPMAN TILTING-DISC CHECK VALVES

IT'S THE VALVE WITH CUSHIONED CLOSING!



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

When you reduce slamming you reduce the hazard of rupturing pipe lines, opening up joints . . . . a host of maintenance problems.

That is why we suggest you investigate Chapman Tilting-Disc Check Valves. The balanced disc in this unusual valve lifts away easily in opening . . . rides smoothly on the flow . . . closes quickly but quietly. There's no slamming . . . minimum wear on valve parts and minimum stresses on pipe lines.

Special designs with dashpots are also available for use under unusual operating conditions, where no self-acting Check Valves can function satisfactorily.

Made in both iron and steel . . . pressures up to 3000 pounds.

You'll find it will pay you to write today for more information on this valve developed by Chapman. Request Bulletin #30.

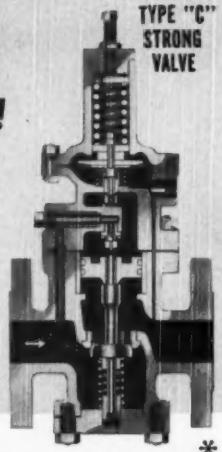
The Chapman Valve Mfg. Co.

INDIAN ORCHARD, MASSACHUSETTS

GET THIS VALVE!

Accurate pressure regulation!

TYPE "C" STRONG VALVE



FOR HEATING OR PROCESS JOBS:

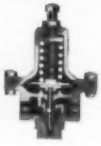
- ...with intermittent or fluctuating demand;
- ...requiring accurate control;
- ...where dependability is essential.

For positive control, use this STRONG* single-seated, pilot-controlled valve!

Simple design, extra-heavy construction make STRONG's Type "C" regulating valve give trouble-free regulation. Semi-steel for pressures to 250 psi, 450° F.; cast steel to 600 psi, 750° F. With Anum-Metl† seat and disc, this valve automatically adjusts itself to control the flow of steam, air or gas required to maintain reduced pressure.

Write us about your pressure reducing problem or request our complete steam specialties Catalog 68-P.

TYPE "O"



Direct operated. Semi-steel construction suitable for initial pressures to 225 psi, 400° F. For steam, air, water or gas.

Features internal strainer, Anum-Metl† seat and disc. Direct operated, of extra heavy semi-steel, this valve is suitable for pressures to 225 psi, 400° F.

TYPE "K"

*Trade Mark Reg. U. S. Pat. Off.

STRONG, CARLISLE & HAMMOND COMPANY

1392 WEST 3rd Street
Cleveland 13, Ohio

† ANUM METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

No. 070 Small Trap

"SY" Strainer

800 Series Steel Trap

STRONG

ELECTRONICS

(*Continued from page* 119)

flame before opening of the oil valve causes relay No. 2 to drop out, and open the circuit to the oil valve through contact $2R_3$. Since gas and ignition are still on, the pilot may relight to close relay No. 2 again, after which the flame-lighting sequence will proceed in a normal manner.

If the pilot flame is not started again within 30 to 45 sec, safety switch opens and drops out relay No. 1, and closes the alarm circuit. A manual reset button on the safety switch must be pressed before the control can recycle.

Another condition is where the main flame fails after opening the oil valve but before the pilot is disconnected. Since the pilot is still on, no change occurs, and the pilot should relight the main flame immediately. If the main flame does not ignite during the ignition overrun of 1 to 60 sec, relay No. 2 will drop out when relay No. 4 pulls in and opens contact $4R$ in the ignition and pilot gas-valve coil circuits. Main flame through phototube P is now responsible for holding No. 2 relay closed, but it cannot, because there is no flame.

When No. 2 relay drops out it opens contact $2R_3$ in the oil valve coil circuit and this valve closes. Contact $2R_2$ in relay No. 1 circuit opens to put the safety switch back in circuit and it begins to heat. The burner motor continues to run, but in 30 to 45 sec the safety switch opens, to break the circuit through relay No. 1 coil to open this relay, and energizes the alarm circuit.

When No. 1 relay drops out it opens contact $1R_4$ in the cathode heater circuit of time-delay relays No. 3 and 4. As soon as their heaters cool, these relays open and the burner motor stops when contact $4R_3$ opens. The reset button on the safety switch must be pressed before a new cycle can begin.

Failure of the main flame during normal operation causes relay No. 2 to drop out. After 30 to 45 sec, safety switch warps out and relay No. 1 drops out removing the cathode-heater voltage from time-delay tube T_2 and T_3. Fifteen seconds later relays No. 3 and 4 drop out, stopping the burner motor. Again the reset button must be pressed before a new sequence can be started.

False-Flame Indication. If a false-flame indication occurs, such as an electronic component failure during an off-flame period, relay No. 2 pulls in and opens contact $2R_1$ in No. 1 relay coil circuit. This relay now cannot close to initiate a starting cycle. Contact $2R_3$ closes and connects the safety switch in circuit from S_1, the safety switch, its heater HS, contacts $2R_2$ and $3R_1$ to S_2. Between 30 and 45 sec later

LUBRICATION COST?

...JUST A MIDGET IN A MOB!

That's how lubrication sizes up against the many other production factors which determine your unit costs! Yet, this "midget in a mob" can effect king-size savings for you by raising machine efficiency, cutting friction losses, reducing maintenance expense.

But it takes more than just "drops of oil and dabs of grease" to assure these benefits... it takes men who know your machines and their exact lubrication requirements. Socony-Vacuum provides both the knowledge and the products... through a program of *Correct Lubrication* engineered specifically for *your* plant.

For the *genuine* savings of Correct Lubrication, call your Socony-Vacuum Representative.

SOCONY-VACUUM

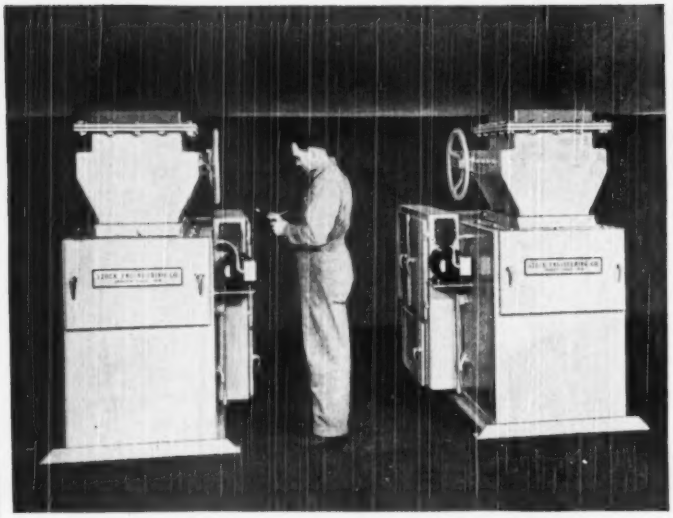
GARGOYLE Lubricants

SOCONY-VACUUM

Correct Lubrication

WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION



CLEAN BOILER ROOMS RESULT WITH

DUST-TIGHT S-E-CO. COAL SCALES

S-E-Co. Coal Scales are built with a steel plate body which is welded into one dust-tight unit. Forged steel hinges, specially designed latches and rubber gaskets make the access doors dust-tight. As a result, the complete scale unit is dust-tight. In fact, special scales are available which will be dust-tight even with 5 pounds of internal air pressure.

For clean boiler rooms, investigate the dust-tight design of S-E-Co. Coal Scales.

Write for bulletin.

STOCK EQUIPMENT COMPANY

715 P Hanna Building ★ Cleveland 15, Ohio

the safety switch warps out, energizing the alarm.

It is impossible for thermostat *H* to initiate a starting cycle even if the reset button on the safety switch is pressed. Relay No. 2 is closed and opens contact $2R_1$ in the start circuit of relay No. 1. Cause of the false-flame indication must be removed before a starting cycle can be initiated.

If the false-flame indication occurs during an on-flame period, system will continue to operate normally until the call for heat ends. At this time thermostat *H* opens its contacts and breaks the circuit through No. 1 relay coil. This relay drops out, but No. 2 is held closed by the false-flame indication, and puts the safety switch in circuit as previously described.

If any one of the contacts—low-water, oil-thermostat or high-pressure—opens it will shut down the system without motor overrun and return everything to starting position. This is because the power supply is interrupted to No. 1 relay, the burner motor, oil valve, gas valve and ignition. If motor overrun is needed, it can be had by using a low-voltage operating control.

Safety features in this control have been described in quite some detail as they show what may be had in modern *flame-failure protection if required.*

In addition to the companies mentioned in this and the preceding articles on *Combustion Safeguards*, others who contributed data include Bailey Meter Co, Stack Engineering Co, Combustion Control Corp, Taco West Corp and Drying Systems, Inc.

Next article will study the electronic circuits for controlling output speed of magnetic drives connected between constant-speed ac motors and their loads.

TECHNICAL BRIEFS

(*Continued from page* 132)

area, coal was pulled out and gas put in with oil as a standby.

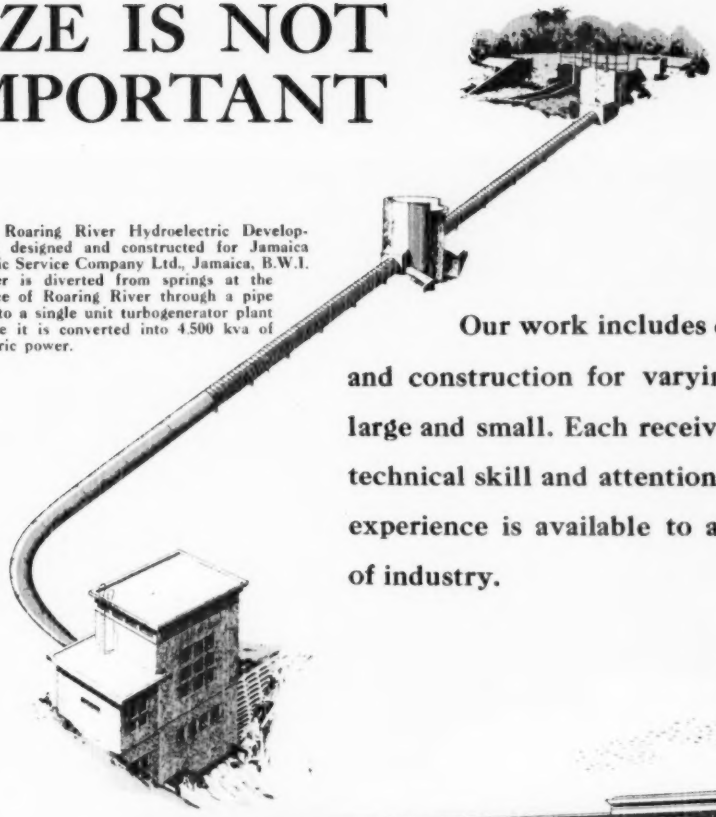
During the war a 20,000-kw turbine-generator went in on the main turbine floor. This took care of the full steam output of the boilers but left some 5000-kw turbine capacity unused.

Several ideas were discussed to make up the steam shortage. But to put in a fourth boiler at that time meant a long wait and a high cost installation. Other suggestions were (1) supply steam from external sources for heating feedwater (2) separate gas-fired feedwater heater (3) install a single cycle gas turbine operating on natural gas and equipped with exhaust-gas recovery heat exchanger for feedwater heating.

All except the gas turbine would be at a sacrifice in station heat rate. So the gas turbine went in.

Authors describe the general arrange-

SIZE IS NOT IMPORTANT



The Roaring River Hydroelectric Development designed and constructed for Jamaica Public Service Company Ltd., Jamaica, B.W.I. Water is diverted from springs at the source of Roaring River through a pipe line to a single unit turbogenerator plant where it is converted into 4,500 kva of electric power.

Our work includes engineering and construction for varying projects, large and small. Each receives the same technical skill and attention. Our broad experience is available to all branches of industry.

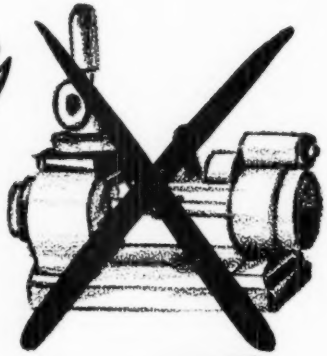
This Service Building for Alexandria and Arlington Area, designed and constructed for Virginia Electric and Power Company, houses offices for outside departments and general storerooms.

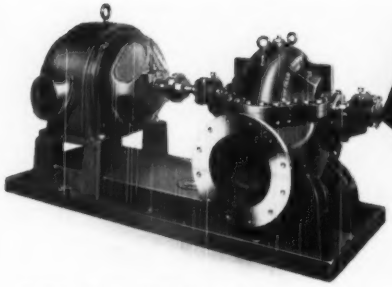
Manufacturing Building at Watertown, Massachusetts designed and constructed for The Prudential Insurance Company for occupancy by Manning, Maxwell & Moore, Inc. The total floor area is 136,000 sq. ft.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

Yesterday's Pumps Doing Today's Job?

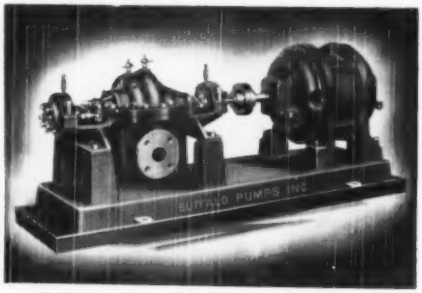




REPLACE with "Buffalo" PUMPS

- **YOU'LL SAVE IN MAINTENANCE**
- **YOU'LL SAVE IN POWER CONSUMPTION**
- **YOU'LL REDUCE PROCESS TIMEOUTS**

Buffalo Type "SL" Pump for Clear Water Service, 10 to 10,000 gpm Capacities. Write for Bulletin 955-N.



Buffalo Class "RR" Pump for Boiler Feed Service. Write for Bulletin 980-B.

YES—if you are doing a present-day capacity job in your plant, but doing it on pumps that have long been obsolete—it's a money-saving proposition to replace with modern "Buffalo" Pumps!

You'll find that, where those old pumps were continually on the "repair list", and were hogging power, your "Buffalo" Pumps will use little power for the work done—and require practically no attention over many years.

And there's a "Buffalo" Pump for best work on every special job—clear water or chemical. WRITE US YOUR PROBLEM—for the best replacement you can make.

"Buffalo" PUMPS

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A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

"Piping by Midwest" means the very best in piping at lower completed cost. Being accurate in dimension and alignment, Midwest subassemblies are easy to erect . . . difficult operations are performed in our fabricating plants and field work is simplified. When desired, Midwest will also erect the piping with undivided responsibility. You will find it to your advantage to call on Midwest whenever you need piping.

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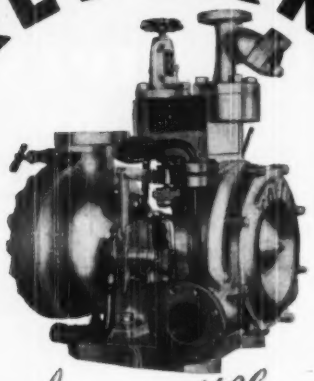

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Turbo Boiler Feed Pumps

Application: Coffin Turbo Pumps are used throughout the marine industry for boiler feed and other applications where the following specifications permit:

STEAM PRESSURES TO 850 PSI
BACK PRESSURES TO 200 PSI
PUMP CAPACITIES TO 500 GPM
DISCHARGE PRESSURES TO 1100 PSI (Heads to 2500 Feet)
LIQUID TEMPERATURES TO 300°F

Dependability: Coffin Pumps are individually engineered to each job to such fine tolerances that noise and maintenance are practically eliminated. *10,000*-hour continuous service periods, *between inspections*, are not unusual. Rugged, simple design, proved by years of experience in marine installations, assure you the same maximum satisfaction that other owners and operators have experienced.

Sales and Service: Coffin Pumps are sold and serviced throughout the marine industry by a group of specialists with a broad background of experience in marine requirements. With service on an overnight basis and parts depots strategically located to give fast shipment, Coffin is in a unique position to help you keep your ships moving . . . at a profit.

160

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ments and connections to the existing station, selection of accessory equipment, changes in the gas-turbine unit itself, construction and assembly. *ASME paper. No. 50-SA-35.*

SAFETY MARGINS AND STRESS LEVELS IN HIGH TEMPERATURE EQUIPMENT, *by E L Robinson, General Electric Co.* During the past decade, equipment for high-temperature operation has greatly increased—so much so that the author feels it desirable to examine safety factors used in proportioning high-temperature apparatus and to review working stresses in their design.

By continuous review of these procedures engineers can better take advantage of extended knowledge of performance and design, using existing materials. A wide variety of tests on standard materials can be applied to new ones to evaluate their possible applications.

For generations structures have been proportioned with a safety factor relative to the material's tensile strength, which might be 3 or 4 or 5 to 1. The tensile test is quite arbitrary.

Now with development of a complex elastic analysis and perfection of analytic and mechanical means of determining local stress maxima, a factor of safety relative to elastic limit of the material can be set. In some cases the real safety margin may be between the elastic limit and the tensile strength rather than between the design stress level and the elastic limit.

The author continues to relate the different factors currently in use in high-temperature equipment to the physical properties as the latest testing techniques determine them. *ASME paper. No. 50-SA-28.*

PLANT PROBLEMS

(*Continued from page* 128)

care of vibrations, expansion and misalignment.

(2) Remove brick stack and run vertical exhaust pipe up side of building. Discard flange outside building and use long-radius welding elbow to connect to vertical pipe. Drain elbow.

Suspect installation was made by a contractor who lacked sufficient engineering skill to design and erect the plant. If this is so, muffler may not be suitable or not properly located in exhaust system.

AK should also write engine manufacturer and a builder of mufflers. These people should set him right.

H T LIVINGSTON *Los Angeles, Calif.*

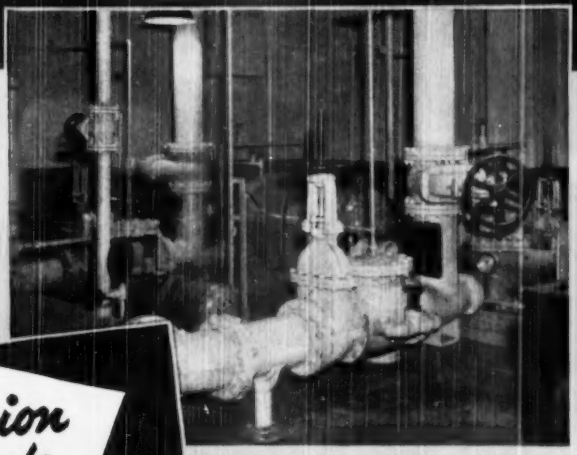
Build Gas Deflector

CLOSE OFF STACK with brickwork below exhaust line. Build brick and refractory deflector with face opposite exhaust line at about 45 deg with vertical. It

...IN THE NEW

UPJOHN

PHARMACEUTICAL PLANT...



An installation of 12-inch OIC gate valves in the ultra-modern UPJOHN plant at Kalamazoo, Michigan.

1,500 acres of buildings and facilities devoted to one purpose—to produce pharmaceuticals with high standards of quality and potency. The Ohio Injector Company is proud to have had OIC Valves included as part of UPJOHN's program.

OIC Valves are *precision engineered* and *precision built* for most efficient control of flow of air, gases and liquids. OIC engineers will help planners and builders select valves best suited for each job—*precision application* help.

For a free copy of the 1950 OIC Valve Cross-Reference Chart, see your local OIC distributor, or write us direct. The Ohio Injector Company, Wadsworth, Ohio.

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VALVES

FORGED AND CAST STEEL · IRON · BRONZE

The New

ROTOJET

Gives you the POWER to clean tubes FASTER

You won't believe any tube cleaner can pack such tremendous power, until you try the new ROTOJET. It removes scale so much faster that it usually pays for itself in one cleaning. Models available for practically any size straight and curved tubes. Send for ROTOJET Bulletin.

THE SECRET

ROTOJET Motor has only two moving parts, a shaft and a paddle. Positive contact between paddle and Rotocentric (egg-shape) bore cylinder prevents stalling at low speeds. No leakage. Delivers maximum power for air used.

S-530 ROTOJET Air-driven Motor with swing-frame head for 3¼–3-13/16" I.D. straight tubes.

ELLIOTT COMPANY-ROTO DIVISION

153 Sussex Avenue Newark 1, N. J.

should be slightly off square horizontally to give swirling motion to gas in stack. Face should be hollowed out like a spoon and lined with refractory.

Support deflector on layer of asbestos and put a similar layer at back and sides. Use thimble and packing around exhaust pipe where it enters stack.

Certain types of mufflers transmit the blow from exhaust gas to the pipe. If this is the case, *AK* may need another type muffler or he may be able to moldify his present muffler so direction of gas is not changed so abruptly. When considering another muffler, don't skimp on size.

GORDON C LEWIS *Vancouver, B.C.*

Hot Muffler?

SOME MEANS for cleaning oily carbon deposits from muffler should be provided. Burnout of muffler generates great heat in exhaust and stack. But it may not be a problem in this instance.

I suggest using an expansion joint where exhaust pipe and manifold join. Fit should be loose. Pack with asbestos rope. Use a flue thimble of tile or concrete at stack entrance and pack with asbestos rope. Cast iron is also suitable. Internal diameter of flue must be 2 in. greater than OD of exhaust pipe.

F A BUTLER *Dallas, Tex.*

Allow for Expansion

FLEXIBLE METAL HOSE between manifold and muffler will isolate vibration and take up any expansion. Exhaust piping and muffler should be supported independently from above.

Impingement of exhaust gas on brick may cause cracking. A 90-deg-long-radius elbow at end of exhaust line will direct gas upward. This prevents high-temperature gas circulating around region where exhaust pipe enters stack. Also, use a packed joint where pipe passes through stack.

C E HOITT *New York, N.Y.*

Improper Expansion

IT SEEMS TO ME that exhaust line isn't expanding properly. I advise *AK* to install a flexible expansion joint ahead of muffler to take up initial expansion and pulsation, which causes stack cracking and flange spreading. I believe his problem will be solved if he does this.

H E ALEKNA *Brownsville, Texas*

Line May "Kick"

VIBRATION MAY CAUSE the trouble. If vibration frequency induced by engine speed is resonant with natural period of vibration of exhaust pipe and supporting structure, vibration may be

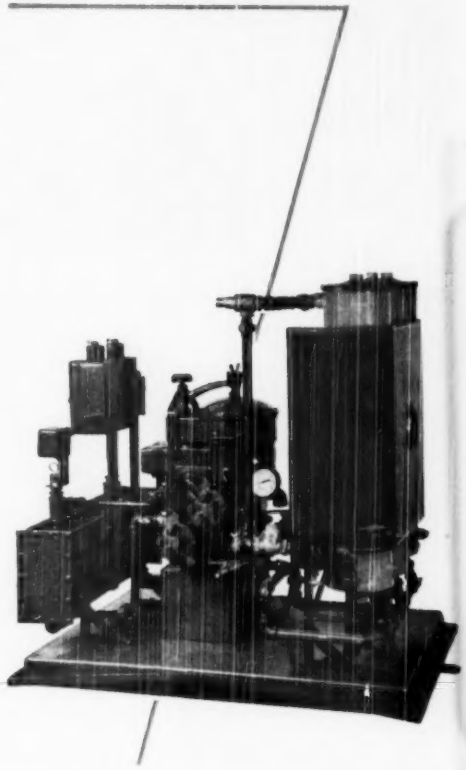
GET RID OF *GUMS, SLUDGES and COKING*

with the DE LAVAL "PURI-FILTER"

The materials in Diesel lubricating oil that cause ring sticking, sludging and "coking" can readily be removed by the De Laval "Puri-Filter." The "Puri-Filter" consists of a De Laval Centrifugal Oil Purifier in combination with Fram filters. The action of centrifugal force and filtration is so powerful that it readily frees Diesel lubricating oil of these solids that cause trouble.

While it is true that many detergent oils enable such solids to remain in suspension, the "Puri-Filter" provides a simple, sure way of eliminating these impurities as fast as they form. The "Puri-Filter" is the finest means ever discovered for keeping Diesel lubricating oil ***really*** clean, and, of course, dry.

The De Laval "Puri-Filter" is surprisingly economical to operate. The centrifuge takes out such a large percentage of all impurities that cartridges in the filters need be replaced at relatively infrequent intervals.



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 · 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

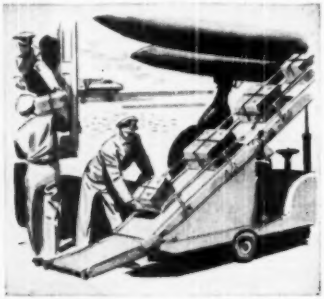
DE LAVAL *Oil Purifiers*

FOR DIESEL LUBRICATING OIL

Completes 300 TV sets— meets daily quota (at a cost of $4.70)

Delicate coils were needed by Midwest manufacturer to complete 300 TV sets . . . and Massachusetts supplier was 920 miles distant! Air Express assured delivery by 8 o'clock next morning, so manufacturer ordered 500 men to report for work. Shipment arrived 7:20 A.M.—production rolled! Shipping cost for 17-lb. carton only $4.70! Manufacturer uses Air Express regularly to keep business in high gear.

$4.70—and special pick-up and delivery included! Low Air Express rates cover door-to-door service. More convenient—easy to use. Just phone for pick-up! (Many low commodity rates in effect. Investigate.)



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A service of
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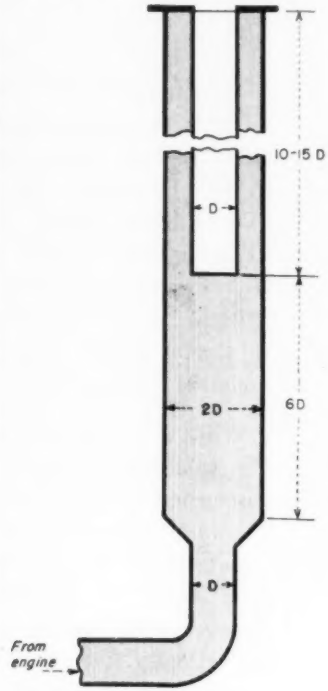
loosening bolts. There may also be at stack a "kick" that cracks bricks.

Calculate natural period of vibration of exhaust pipe and structure. Compare with frequency of vibration of engine speed. If vibrations, or their harmonics are in resonance, destructive vibrations can be produced in exhaust pipe.

Natural vibration period of exhaust pipe can be raised above engine speed by stiffening supporting structure.

W H Miller *Lancaster, Pa.*



Build Stack Muffler

Take muffler out of engine room and place it in stack, if possible. If it is too big to fit in stack, build one as in sketch. It works like this:

As each exhaust wave travels through line, part of gas is compressed between inner and outer tubes. Wave moves back down pipe where it meets an outgoing wave. Collision tends to break up this outgoing wave. Trick is to make inner tube correct length. Experiment until right length is obtained.

Ira A Butcher *Cincinnati, O.*

ULTRASONICS

(*Continued from page* 104)

making a total of 180 deg, which is half of the 360 deg traveled by the beam giving the right-hand return signal.

Plastic-filler piece has to be shaped to the radius of the pipe being tested.

RIC-WIL GIVES YOU

Sealed-in PROTECTION

FOR YOUR INSULATED PIPING SYSTEMS

Whether your insulated piping carries steam, hot water, oil, or process liquids, it is given maximum sealed-in protection and efficiency by Ric-wiL Prefabricated Units.

In Ric-wiL HEL-COR Units the piping is insulated with the most efficient material to fit its specific thermal requirements. Both pipe and insulation are housed in a protective 16-gauge helically corrugated ingot iron conduit, hot-dipped galvanized. The outside is given a heavy coating of high-temperature asphalt and is tension-wrapped with asphalt-saturated asbestos felt. The inside is protected with multicoat, baked-on type Phenolic Resin.

The ends of HEL-COR units are sealed at the factory with a heavy ring of insulating cement and special water-repellent packing to give full protection during shipping and installation.

All prefabrication is done in modern factories by skilled workers, using only the finest known protective and insulating materials.

Simple, quick "on the job" field connections may be full-welded and the entire system air-tested for tightness, providing sealed-in protection for long and efficient service.

The Ric-wiL representative nearest you will be glad to show all the advantages of Ric-wiL Prefabricated Piping as applied to your insulated piping problem.

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FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

Now... with the **FEED**

TYPE 149

Ample Power for Direct Action ...Easily Adapted to Remote Control

For Quick Solutions of Tough Problems, Count on *Climax!*

You'll be amazed at the ease with which a BS&B Controls Engineer can end your control worries. Strategically located, he is always ready to give you complete, understanding service... in strict confidence. Check the coupon below for the BS&B Controls Man nearest you.

You have a leverage ratio of 18 to 1 forming the connection between float and inner valve plug in the valve body of the BS&B-Climax 149 Feed Water Regulator. This means ample power to operate against differentials across the valve as usually encountered. Designed to serve as Feed Water Regulator or as Liquid Level Control. Combines the economy with the proved efficiency of Climax top-and-bottom-guided, reversible valve bodies.

Employ the type 149 float cage for direct control of level, remote of valves or instruments through air pilots, and operation of alarm systems or signals through Mercoid switches. Yes, sir... you can't beat this BS&B-Climax Control for versatility!

BLACK, SIVALLS & BRYSON, INC.
Climax Controls Division, Section C1-6-10
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Send complete information on following items, as checked: ☐ Type 149 Feed Water Regulator ☐ Type 320 Pressure Reducing Regulator ☐ Type 88 Diaphragm Valves ☐ Type 850 Displacement Liquid Level Controllers ☐ Have Sales Engineer call. Also send name of nearest BS&B Controls Man.

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Models available... in high tensile cast iron for pressures up to 250 psi, cast steel for up to 500 psi.

Complete description, diagrams, specifications and applications are ready for you. Mail the coupon... today!

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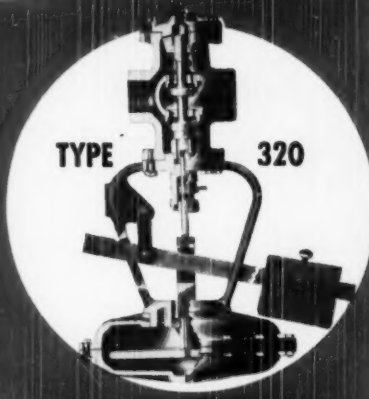
Efficiency at a Real Saving

New BS&B Climax WATER REGULATOR

PRESSURE REDUCTION OR BACK PRESSURE REGULATOR

Type 320 Regulators allow sensitive pressure control in vapor-vacuum and low-pressure steam heating systems. Weight loaded, pressure operated, diaphragm actuated. Built for long life under rugged conditions.



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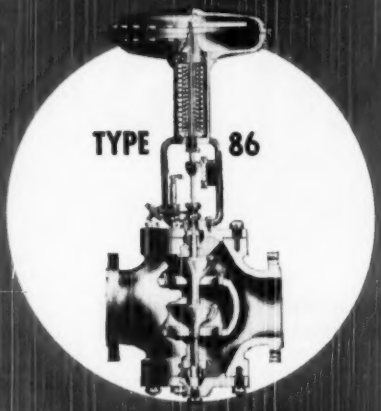
Type 86... famous the world over for high lift, accurate control, ease of maintenance. Fully reversible in the field. Super-polished lower stem for minimum friction. Wide rangeability. Check coupon for catalog.



DISPLACEMENT LIQUID LEVEL CONTROLLERS

No leakage... no stuffing box... no friction problem! That's the Type 850, a BS&B-Climax-developed exclusive. Ideal wherever liquid level control involves exacting and wide range control. Shown here with Type 1410 BS&B-Climax Control Pilot. Complete catalog available... send coupon now.

This is done by rough forming on a machine and finishing with sandpaper placed over the outer pipe surface. For inspection of bend arcs a set of three filler pieces is generally satisfactory for a given pipe size. To keep the filler piece in sonic contact with the crystal mounting face and the pipe surface, a film of SAE 20 or 30 oil is maintained between these surfaces. Loss of the end reflection warns that sonic contact is poor or missing. The operator, however, soon develops a "feel" that aids in keeping contact. Heavy scale, paint or gummy materials on the pipe surface interfere with testing. Rust, light oxide coating or a complete coating of varnish does not usually interfere with sound transmission through filler piece to pipe surface.

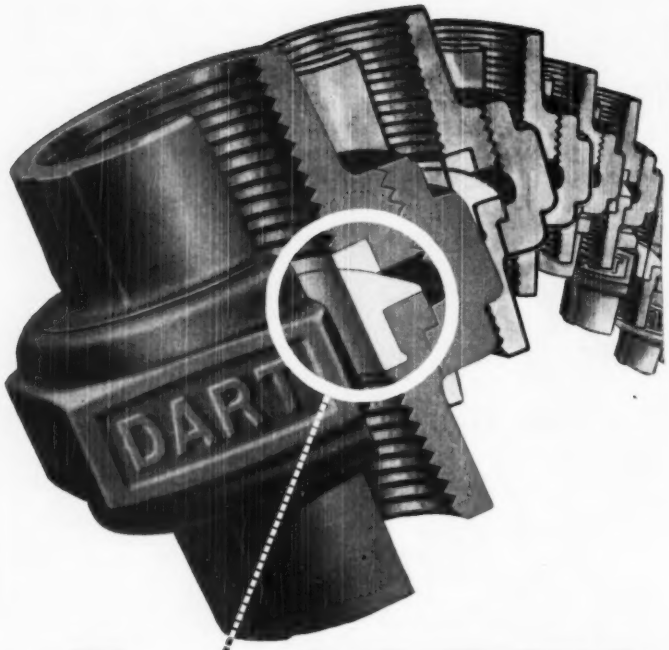
Straight-beam testing from the end of the pipe has also been investigated. Since, however, most pipe defects are inherently longitudinal (being laps, folds or longitudinal cracks) the straight beam proves inadequate. Shallow surface defects are missed entirely with longitudinal testing, while gross defects of about half pipe-wall thickness in depth disperse the sound beam without reflecting it. These do, however, show their presence by obscuring or greatly reducing the end reflection.

Shop Procedure. First step in shop inspection with ultrasonics is to set up the "standard of acceptance" or "standard of sensitivity." Specification generally used requires exploration and repair of defects exceeding 5% of wall thickness. (ASTM Specification A-158 permits certain surface defects up to 5% of nominal wall thickness of pipe, provided they do not encroach on minimum wall thickness.) To set this standard on the oscilloscope, a 1/16-in.-wide notch having a depth equal to 5% of pipe thickness is cut into the surface at one end. The "gain" or height of reflection of this artificial defect on the sweep is adjusted (for the crystal size and frequency being used) to show about ½ in. above and below the sweep. Any area showing a reflection equal to or greater in height than this standard is marked and investigated.

Several thousand feet of pipe have been ultrasonic-inspected by Kellogg in recent months. This includes 1¼- and 2-in. Schedule 160 ferritic-alloy pipe, and various schedules of 6-, 8- and 10-in. pipe of ferritic alloy and austenitic materials. Several major defect areas have been revealed as well as many minor laps and folds 2 to 4 in. long, but exceeding 5% of wall thickness in depth. Inspection of pipe after hot bending has not disclosed any defects to date. All work used the Sperry reflectoscope with angle-searching holder.

Weld Inspection. There is no question

(*Continued on page 202*)



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For Longer Service

This True Ball Joint Makes the Difference

Easy to Tighten! Because of the spherically-ground joint, Dart unions always fit snugly — bronze seat to bronze seat. Moreover, they close easily and stay tight. No need to jam a Dart.

Easy to Uncouple! Darts uncouple easily, too. Seats are unmarred—ready for repeated use.

Practically Indestructible! To ensure the ultimate in protection, both body and nut of a Dart are made of practically indestructible high-test, air-refined malleable iron. One more of the many reasons why Darts are first choice of careful buyers coast to coast.

E. M. DART MFG. CO.
Providence 3, Rhode Island

DART
UNIONS

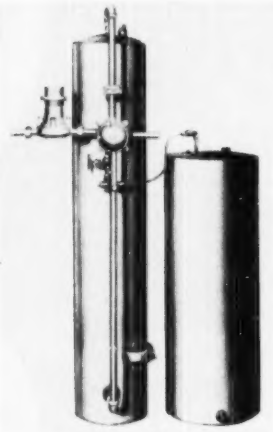
EQUIPMENT NEWS

(Continued from page 152)

fuels are diesel or carbureted. Model 180-DACU rating is 22 hp, Model 185-DACU 33 hp, and Model 190-DLCU 45 hp, all at 1800 rpm.

The three natural-gas, butane and gasoline power units, which are counterparts of the diesel power units, and which have interchangeable mountings, can be supplied with gas, gasoline or combination gas-gasoline carburetors. Being high-compression overhead-valve engines, no change other than carburetor and timing adjustment is needed when switching fuels. Mounting dimensions are identical for each size. All units are available with or without clutch and power takeoff.

Waukesha Motor Co, Waukesha, Wis.



WATER SOFTENER P1033

Small, zeolite-water softener, *Junior Industrial*, for installations under 100 gal per minute is supplied in two groups and in single and double units. Group I comes in 12, 18, 24 and 30 in. dia and Group II in 36, 42 and 48 in. tank dia.

Single unit is recommended if a storage tank for softened water is available while the softener is being backwashed and regenerated (about 45 min.) Double unit applies elsewhere.

Cochrane Corp, 17th St and Allegheny Ave, Philadelphia 32, Pa.

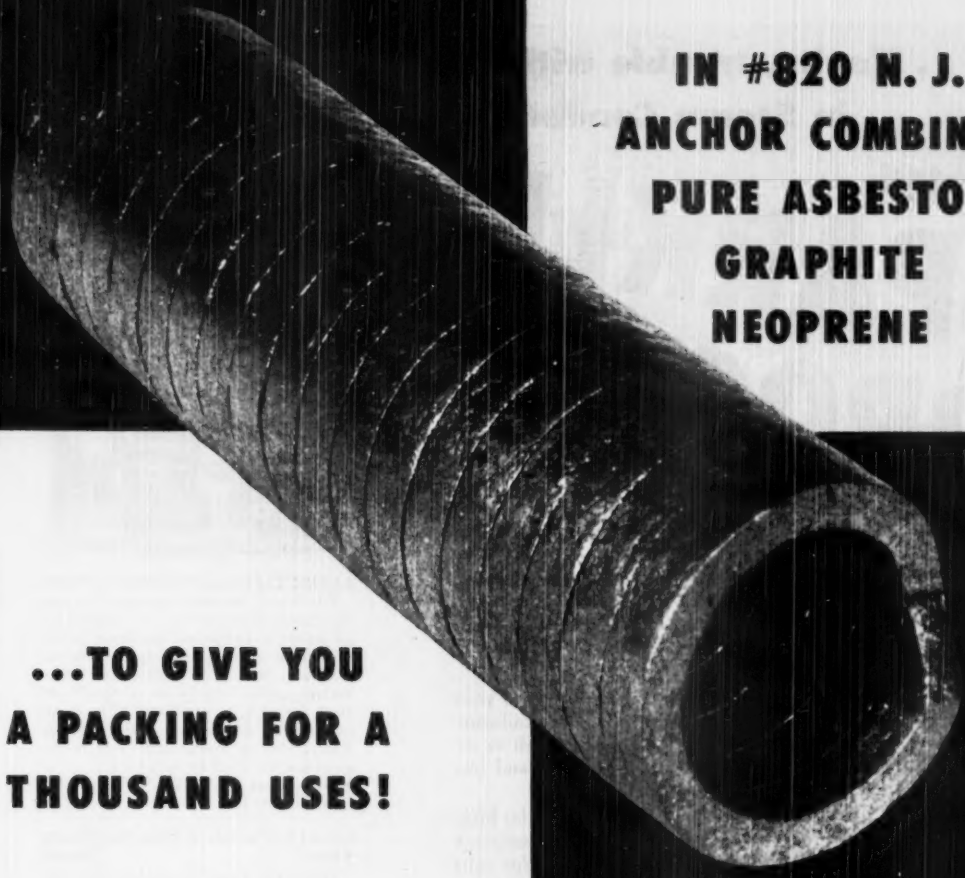
ELECTRIC BOILER P1027

Lower-priced line of electric steam boilers, *Speedelectric* 400, has maximum working pressure of 50 psi. It is available in standard sizes from about 105 to 875 lbs per hr steaming capacity and works from 220, 440 or 550 v, single or polyphase.

Livingston Engrg Co, 100 Grove St, Worcester, Mass.

ION-EXCHANGE RESIN P1019

Medium-capacity cation-exchange resin, *Amberlite* IR-105G, combines the hydraulic behavior of company's *Amberlite* IR-100



IN #820 N. J. ANCHOR COMBINED PURE ASBESTOS GRAPHITE NEOPRENE

...TO GIVE YOU A PACKING FOR A THOUSAND USES!

This packing—CARBONITE #820 N. J.—has the greatest range of uses of any packing known: Steam and Air . . . Chemicals . . . Acids . . . Solvents . . . Water . . . Oil . . . Gasoline.

It is 100% pure asbestos, graphite and neoprene. Perfectly formed rings of any diameter are easily cut from the spirals. No die-forming is required.

"N. J." means "No Jacket." This superior packing is supplied in spiral or ring form in sizes from ⅛" square up to 1" square.

Write us today for further details on this packing-of-a-thousand-uses.

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FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

. . . Having trouble with oil in Steam Condensate?

THE SPARKLER PROCESS

. . . reduces oil down to less than .25 p.p.m. in return condensate, the lowest of any commercial process, by employing Sparkler filters, together with other equipment.

This process is engineered to your requirements and our installation service men will be on the job to see that it works to both your and our complete satisfaction.

Write Mr. K. L. Carr, Sparkler Mfg. Co., Mundelein, Illinois for estimate of the cost of an installation for your power plant.

Filters used in one installation of this process that provides a flow rate of 200 gallons per minute.

SPARKLER MANUFACTURING CO.

MUNDELEIN, ILLINOIS

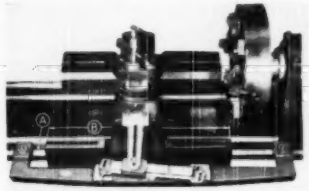
Makers of industrial horizontal plate filters for over a quarter of a century

with the high capacity and regeneration efficiency of IR-105, and replaces these products.

It is a phenolic resin furnished in granular, rather than beaded form, to improve its hydraulic characteristics. Small commercial-scale tests for the past three years have established its physical ruggedness and chemical stability.

Because of its high regeneration efficiency IR-105G adapts itself well to hydrogen cycle operation and is especially useful in deionization and split-stream dealkalization. In sodium form, it is suitable for water softening.

Resinous Products Div, Rohm & Haas Co, 507 Fifth Ave, New York 17, N. Y.



LATHE TAPER ATTACHMENT P1049

Fitted with universal attachment clamps, this taper attachment can be mounted on all makes of engine and tool-room lathes. It can be used for taper turning, boring and threading. Attachment is suitable for lathes having a swing up to 36 in. to cut a taper of 20 deg or 4. in. per ft and 12 in. longitudinally at one setting. Swivel bar has V-ways with graduated ends—one in degrees and the other in in. per ft.

Master-Taper Co, 4531 N Beacon St, Chicago 40, Ill.

PACKLESS DIRECT RETURN STEAM TRAP P1053

Fitted with a packless trunnion this trap dumps about 50 times an hour. It is available in six sizes with capacities from 1050 to 15,000 lb per hr. Elimination of trunnion packing reduces maintenance required on unit.

Morehead Mfg Co, 2455 West Warren, Detroit 8, Mich.

FORCE INDICATOR P1061

A precision force measuring instrument, the *Force Indicator*, has been expanded to twelve models in capacities of one, two, five and 20 lb, 16, 32, 80 and 160 ounces, 500, 1000 and 5000 grams.

A compensated spring mechanism and a fully jewelled dial indicator measure and indicate the force. It is a helpful device in checking forces and pressures in various mechanisms and instruments.

Apparatus Div, Hunter Spring Co, 1 Spring Ave, Phila, Pa.

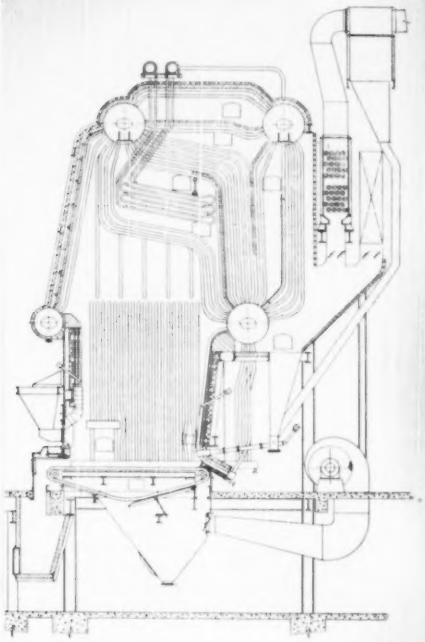
FIRE HOSE FITTINGS P1062

Complete line of fire-hose couplings and accessories is suitable for many types hose. *Le-Hi* satin-finish plug-lug and *Glider* lug coupling can be fitted to chemical, linen, mill and fire department hose. Rounded lugs prevent hose catching on curbs, ladder rungs, stairs and other obstructions.

Suction-hose, spanner hole, navy type and snap couplings are also available. Play-

UNION
STEAM GENERATORS AT BURROUGHS - - - -

33 Years
of UNION Service



Burroughs Adding Machine Co.
Have Used UNION Boilers Since 1917

33 years ago The Burroughs Adding Machine Company installed their first Union Boiler. Periodically since 1917 they have added more Union installations. The latest Union "N" Type boiler equipped with Detroit Stoker is operating in the Detroit Burroughs plant.

The history of Union Boilers in constantly expanding business organizations the country over is similar to the Burroughs story.

Obviously the product gives satisfaction.

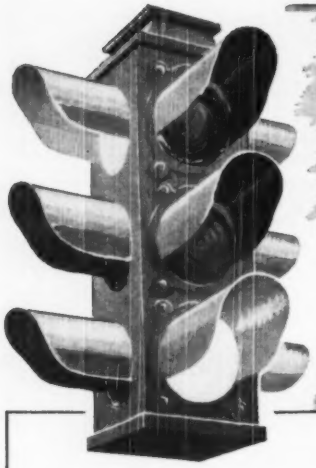
You will do well to select Union Boilers because Union's 60 years of engineering and manufacturing experience goes to work for you in an installation which fulfills your requirement perfectly.

Consult with our engineers . . . you can depend on Union to serve you well.

UNION IRON WORKS . . . *Since 1890*

373 CASCADE STREET • ERIE, PENNA.

BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL



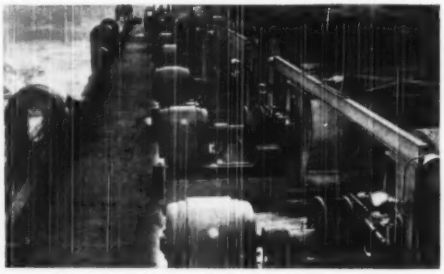
DRAFT FANS GO on GREEN

A Big Draft Job Handled Capably by Green Fans

Twenty-four large Green Fans take care of a heavy draft load at the Venice (Illinois) Plant of the Union Electric Co. of Missouri. Each of six boilers has two sets of Green Fans, each set consisting of one induced draft fan and one forced draft fan coupled to one motor as a unit. With the heavy demands on this station, all boilers are usually in service continuously, thus throwing an unrelenting burden on the fans.

Engineers whose responsibility it is to recommend or accept draft fans for large power plants certainly want efficiency and low operating costs. But they don't overlook the maintenance and replacement angles. They want the sound designs of competent experienced fan engineers. They also want the care in construction that is found in shops of a company that has built up an international reputation as the "authority" on draft fans. They know that such a company will not tolerate sloppy shop work.

Green is this authority on mechanical draft fans.



Have You a Copy of Our Fan Bulletin No. 168? If not, we shall be glad to send you one.

THE GREEN *Fuel Economizer* COMPANY INC.

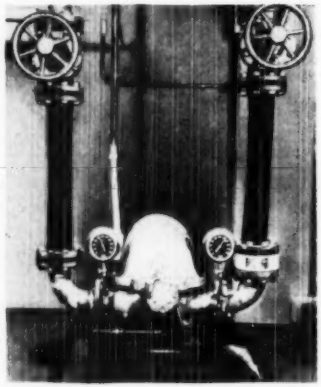
BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

pipes, hose caps, mounting plates and a complete line of rubber gaskets and expansion rings are included.
Hose Accessories Co, Philadelphia 32, Pa.

FIRE-FIGHTING FOAM **P1063**

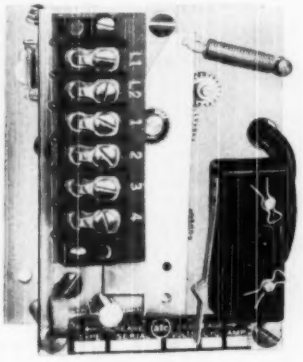
Foam can be used with fog nozzzles in hose lines or fixed piping systems where a proper proportioning plan is provided. It is suitable for fighting gasoline fires and other similar inflammable liquids.
Rockwood Sprinkler Co, 38 Harlow St, Worcester 5, Mass.



PIPELINE NOISE AND VIBRATION ABSORBER **P1037**

Rubber pipe reduces noise in liquid, air and gas piping. Standard flanges at each end of pipe are imbedded in rubber. Flanges bolt to machine and piping. No gaskets are used. Metal-to-metal contact between pump and piping is eliminated.

Soundzorber is designed for working pressures up to 250 psi, ½- to 14-in. pipes. Maximum allowable temperature is 250 F.
Finn & Co, 2850 Eighth Ave, New York 30, N. Y.



MOTOR-DRIVEN TIMER **P1074**

Synchronous motor-driven time-delay device suitable for use in elevator control, machine tools, signal systems, etc. Re-

Installation Techniques are "Pay-off"...

With modern operating temperatures ranging as high as 1050°F. and pressures climbing upwards of 2,000 psig., welding and concurrent heat treating of alloy power piping *during installation* pose critical problems for field crews.

For example, the weld shown in the illustration required a heat treating cycle of over 15 hours. During this time Kellogg crews, using special induction heating equipment, raised the temperature of the weld area at a predetermined controlled rate over a period of some four hours. Upon reaching the proper pre-heat temperature, welding was started as shown in the picture.

As the weld was made the temperature was naturally held at a uniform level. Upon completion, the weld was stress-relieved at a predetermined elevated temperature for over two hours and then allowed to cool at a controlled rate for four hours to complete the cycle.

Over the years such special techniques in connection with welding alloy piping have been developed by Kellogg engineers, who have been entrusted with such recent innovations in power piping as the first HT-HP stainless steel installation and the fabrication of piping for the original 1050°F. station.

The experience of these well-trained field installation crews is one "plus value" obtained when power piping by M. W. Kellogg is specified.

Illustrated—Inspector checks laying of first bead.

Special studies of unusual problems such as graphitization to assure long life and low maintenance.

Metallurgical research by recognized specialists who have made major contributions in this field.

Exclusive Equipment for accurately analyzing stresses in piping and providing unique data for critical installations.

Complete facilities for the fabrication of steel products from simple forgings to specially cast bi-metallic devices.

Top welding performance in shops and in the field by welders accustomed to working under X-Ray checks.

Quality control, devised by metallurgical experts, embracing forming, heat treating and non-destructive testing.

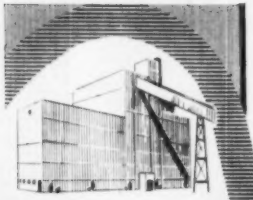
To make temperatures and pressures do piping and process equipment

M. W. KELLOGG

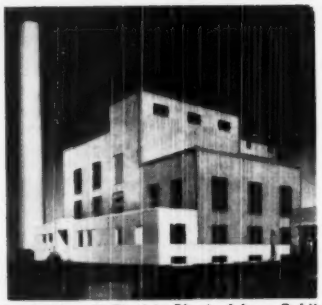
Vessels
Exchangers
Condensers
Process Piping
Forged and Welded Fittings
Radial Brick Chimneys

★

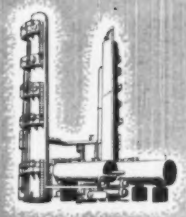
The M. W. Kellogg Company, Inc. (A subsidiary of Pullman Incorporated) Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.



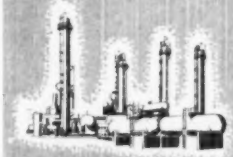
POWER DIVISION



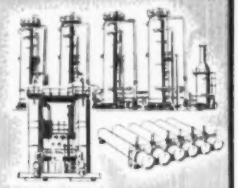
7500 Kilowatt Electric Plant of Iowa Public Service Co. at Eagle Grove, completed fall of 1949



CHEMICAL DIVISION



PETROLEUM DIVISION



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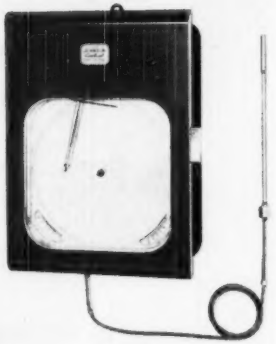
setting is handled by an electromagnetic coil that positively clutches and releases a trip locking gear as required.

Timer is rated for 115 v or 230 v; 25, 50 or 60 cycles. Switches are rated to carry 10 amp at 115 v and 5 amp at 230 v, ac, noninductive load.

Automatic Temperature Control Co, Inc, 5212 Pulaski Ave, Philadelphia 44, Pa.



RECORDER-CONTROLLER P1035

Proportional action, recorder controller, *Record-O-Stat*, has automatic reset feature, which coordinates deviation in control with various thermal lags inherent to the system under control.

Entire temperature measuring system—bulb, capillary tubing, high-torque helical equipment—is liquid filled. With a relatively low pressure in the system, bulb walls can be thinner and this improves conductivity through sensitive portion of temperature measuring bulb.

Johnson Service Co, 507 East Michigan St, Milwaukee 2, Wis.

SEMI-METALLIC PACKING P1016

Self-sealing, semi-metallic, self-lubricating steamfitters' packing works well on steam, gasoline and oil valves for temperatures to 350 F and pressures to 125 psi.

The new packing is available in 1/16 in. diameter. Its small size makes it self-forming. Heat or steam do not affect its lubricating quality and neither does the solvent action of gasoline.

Packing Div, Flexrock Co, 36th & Filbert St, Philadelphia 4, Pa.

GEARSHIFT DRIVE P1010

A selective-speed gearshift has both primary and secondary gear reductions. It is designed to motorize machines that require a low range of selective operating speeds combined with high-torque capacity. Unit is compact combination of 5-hp 1200-rpm integrally mounted electric motor and 4-speed sliding gear transmission. The latter has primary and secondary gear ratios that give choice of output speeds of 123 to 1140 rpm.

Drive delivers full rated horsepower at each of its four speeds. Constant-torque or constant-horsepower 2-speed motors may

BAD AIR IS COSTLY...

... as compared to the blower that keeps air fresh

Your men can't produce at top efficiency when stagnant, hot or fume-filled air robs them of their energy.

Wherever bad air slows down production . . . in shipholds, tanks, drums, boilers or other places where men need fresh, cool air . . . a Coppus Blower becomes both a safety device and a production tool.

Portable and easily adaptable for special purposes, Coppus "Blue Ribbon" Blowers and Exhausters fit all your "fresh air" requirements. The Coppus "Blue Ribbon" means premium performance at ordinary cost. Check and mail the coupon for specific information. Sales offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG, BEST'S SAFETY DIRECTORY, MINING CATALOGS.

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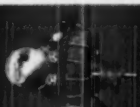


HORIZONTAL TURBINE
Six frame sizes—
1 to 150 horsepower

VERTICAL TURBINE
Six frame sizes—
1 to 150 horsepower

FANMIX GAS BURNER

FANMIX OIL BURNER

MAIL THIS COUPON To Coppus Engineering Corp., 170 Park Avenue, Worcester 2, Mass.

PLEASE SEND ME INFORMATION ON SUPPLYING FRESH AIR TO MEN WORKING:

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fusilages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.
- ☐ drying of walls, sheets; etc., after treated with coating material.

NAME .....

COMPANY .....

ADDRESS .....

CITY .....

(Write here any special ventilating problem you may have.)

Now!
A 6 POINT RECORDER
for as little as $100 per point†

THE MULTI-RECORD DYNALOG* ELECTRONIC RECORDER

Economy is only one of the many advantages offered by the Foxboro Multi-Record Dynalog. It makes up to 6 easy-to-read records (with only 1 measuring system)... in 6 different, brilliant, non-running colors. It prints a reading every 6 seconds, giving practically continuous-line records on economical round charts.

The Multi-Record Dynalog is available for measuring temperature, pressure, flow, or any of a wide variety of other process variables. It's an instrument of the highest precision, offering the extra advantages of easy comparison of records and instrument-space economy. Maintenance is practically eliminated because the Multi-Record Dynalog has no slidewire, requires no standardizing, uses no dry cell. Yet it is unmatched in sensitivity, accuracy, and speed of response. Get complete details. Write for Bulletin 427-1. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.**

*Reg. U. S. Pat. Off.
†Exclusive of sensitive elements

Another FOXBORO FIRST
Reg. U. S. Pat. Off.

be used for additional speeds. Drive operates on polyphase ac, 25, 50 and 60 cycles at voltage below 600. Catalog available.
The Lima Electric Motor Co, Dept AB-59, Lima, Ohio

GROUND TESTER **P1091**

This instrument gives sufficient information to tell if resistance to earth of man-made ground is sufficiently low to insure correct operation and minimize danger from lighting. This new improved set has its own generator for supplying test current.

Each instrument has two scales, permitting open, well-proportioned markings. Two ranges are available, 0 to 40 and 0 to 200 ohms; 0 to 100 and 0 to 500 ohms.
James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa.

CLAMP PIPE COUPLING **P1002**

Available in pipe sizes up to 8 in. in zinc-coated steel or aluminum. Coupling is used for joining either plain-end or threaded pipes or a combination of the two. Applied with a socket or crescent wrench the couplings act as a pipe union. They can be used on oil, water, gas, steam, air or other lines. Rubber-base gaskets are supplied as standard but may be had in cork, fiber glass, neoprene or other materials.
Morris Coupling & Clamp Co, 1396 Beaver St, Ellwood City, Pa.

FLOOR HARDENER **P1071**

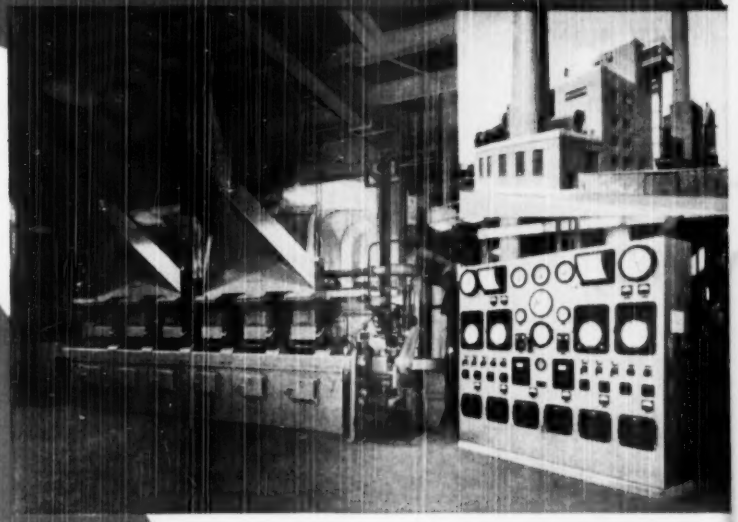
Flintcrust Liquid consists of crystals dissolved in water. It is flushed over concrete floors to fill the pores, forming a hardened, glasslike surface. Result is a floor that is essentially maintenance-free for years.
Flexrock Co, Filbert and Cuthbert St, Philadelphia 4, Pa.

BRONZE GLOBE VALVE **P1052**

Fast-action bronze globe valve has ball- and socket design double disks. Guide rims *A* on these disks rotate on guide tracks *B* cast in body. Operating lever can be placed in four positions on spindle to fit installation. For remote operation, rope, chain or rod can be attached through hole in outer

See what was selected to modernize this steam-electric plant

DETROIT ROTOGRATE STOKERS



Indianapolis Power & Light Company's Perry-K Plant
Indianapolis, Indiana

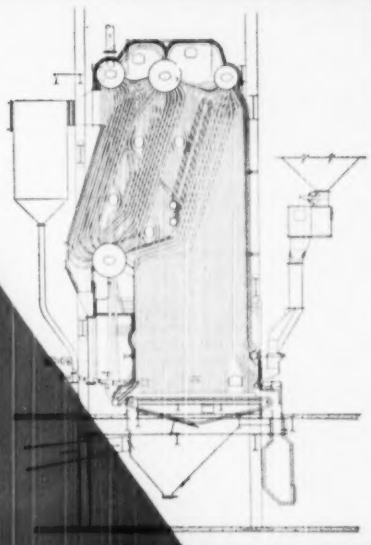
Showing one of the two new 150,000 pounds per hour units. Gibbs & Hill Inc., New York, Consulting Engineers.

Detroit RotoGrate Stokers, spreader stokers with moving grates that discharge the ash at the front, were installed in a plant on one of the Nation's largest steam service systems. Each new Babcock and Wilcox four-drum Stirling steam generating unit is served by a RotoGrate Stoker having six rotors.

Detroit RotoGrate Stokers burn a wide range of coals without special preparation and with high thermal efficiency. Higher burning rates with RotoGrates will produce more capacity per foot of furnace width, keeping down investments in both steam generating equipment and building.

We have an economical firing method to best suit your needs. Burn Coal—The Basic Fuel. An informal discussion with one of our engineers will cost you nothing and may save you a lot.

INVESTIGATE THE ROTOGRATE



There is a type and size of Detroit Stoker for every Industrial and Power Need

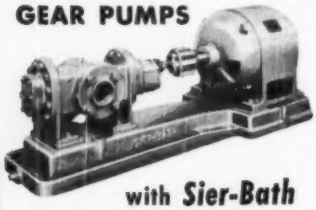
DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY
GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN
District Offices in Principal Cities . . . Works at Monroe, Michigan

PUMP FUEL?

Get These

4 BIG ADVANTAGES OVER GEAR PUMPS



with *Sier-Bath*

SCREW PUMPS!

1—LONGER LIFE, LASTING EFFICIENCY. No metallic contact between rotors or between rotors and casing. Original rotor clearances maintained by precision cut timing gears.

2—LONGER BEARING LIFE. Low radial load because flow is axial. No thrust load because ends-to-center flow is perfectly balanced.

3—LESS STRAIN ON VALVES AND PIPING. Minimum cavitation because pump reduces velocity change. Eliminates hammer, vibration.

4—NO SHUT-DOWN FOR RE-PACKING. Only suction pressure on stuffing boxes. Pump can be kept in operation while packing is added.

ADDITIONAL ADVANTAGES

- Self-priming
- Pulseless discharge
- Direct-connected up to 1800 RPM

If you are not now capitalizing on these advantages—don't fail to ask us for further details. We can supply you with Sier-Bath Screw Pumps perfectly adapted to your particular needs.

AVAILABLE IN TWO GENERAL TYPES: Internal Bearing Type (illustrated) for Lubricating Liquids; External Bearing Type for Non-lubricating Liquids. CAPACITIES: 1-700 GPM; DISCHARGE: 1000 PSI for viscous liquids, 250 PSI for water.

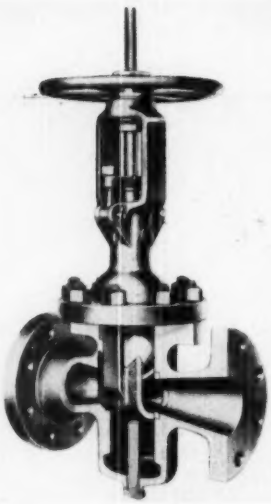
SEND FOR BOOKLET

Founded 1905 Members A.G.M.A.

Sier-Bath GEAR and PUMP CO., Inc.

9254 HUDSON BLVD., NORTH BERGEN, N. J.

end of lever. *Swingtite* is rated for 125-psi steam service, 300 psi cold oil, water and gas. It is made in ½- to 2-in. sizes.
Jenkins Bros, 100 Park Ave, New York 17, N. Y.



VENTURI-BALL VALVE P1041

Designed for throttling applications in high-pressure, corrosive or erosive applications, this valve has straight-line discharge characteristics. Nonturbulent flow is possible over a wide range without erosion or wire drawing. There are two seats, and valve may be reversed in pipeline to increase its life. Valve is available in different materials, depending on service.
W-K-M Co, Houston, Texas

PRESSURE SWITCH P1077

Hydraulic pressure switch that will cut in and out with a 12 to 18% pressure differential. It withstands a temperature differential from —65 F to +160 F without loss of accuracy.
Pantex Manufacturing Corp, Hydraulics Div, Box 600, Pawtucket, R. I.

TUBING STAPLES P1043

Copper staples with steel core are designed to fasten copper and brass tubing used in radiant heating, hot- and cold-water service lines, refrigeration and similar installations. Three sizes are designed to fit ½, ⅝ or ¾-in. tubes. A flat-top staple is used for first two sizes. For ¾-in. tubes a round-wire staple with round top is used.
E H Titchener & Co, Binghamton, N. Y.

BRAZING ALLOY P1022

Heat and corrosion-resistant alloy, Nicrobraz, makes a brazed joint in stainless steels that has strength equal to the parent metal at 2000 F and better corrosion and oxidation resistance.

It can be used to braze 300 and 400 series

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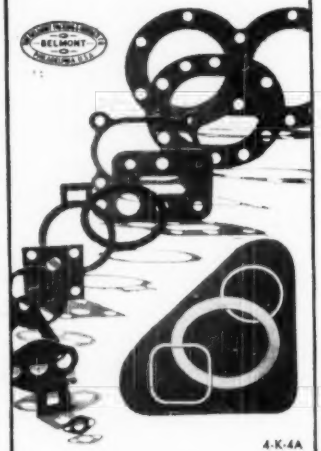
in sizes, shapes, and forms to meet every requirement. You can get Belmont standard and special design gaskets made of compressed asbestos, woven asbestos metallic, red rubber, cloth inserts, black rubber, vegetable fibre, cork-vegetable fibre, gray rubber, neoprene, and a wide variety of compounded materials.

And, Belmont complete manufacturing facilities assure dimensional accuracy, uniform thickness and top quality finish.

Whether your gasket problem is... temperatures... pressure... vibration... shock... oxidation... corrosion... creep... reduction or just a matter of gasket size and shape, if you want BETTER JOINT AND SURFACE SEALING... longer gasket service life—TRY BELMONT.

Distributors located in every large industrial center to serve you. Write for catalog #40.



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Butler & Sepviva Sts.
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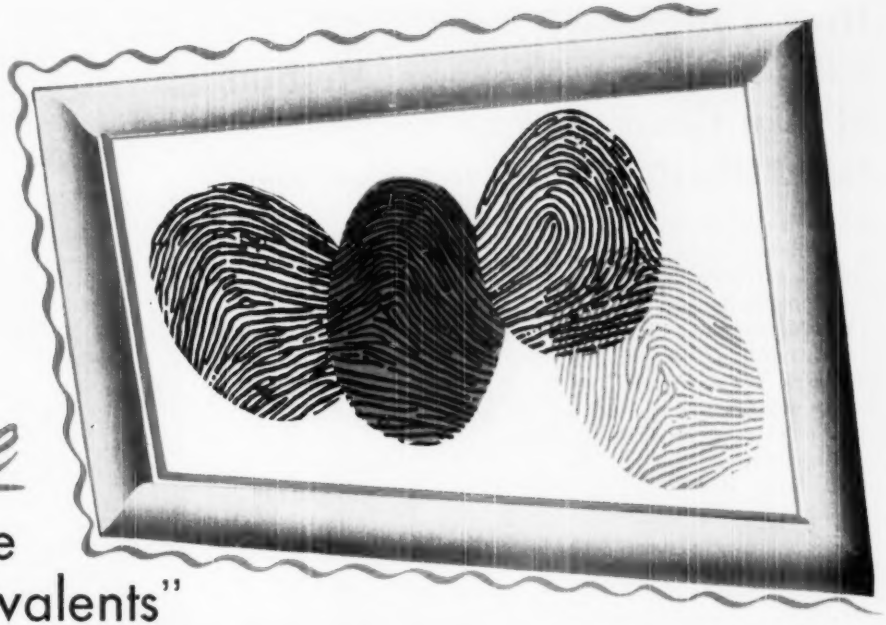
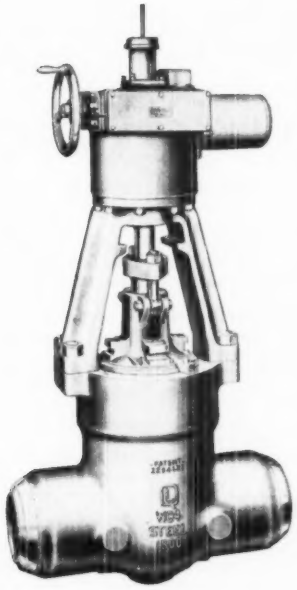


are

there

"equivalents"

to **LUNKENHEIMER** STEEL VALVES?



Well, there are "alternates." But the engineer's familiar specification, "Lunkenheimer Figure 1938 or equivalent," invites a comparison with your thumbprint — and your neighbor's. How "equal" can valves really be? A few characteristics can *almost* be matched. But there is no equal for most Lunkenheimer features. Consider the metal quality of Lunkenheimer steel castings. Their soundness is unparalleled in the valve field. Lunkenheimer metallurgical research has uncovered whole new areas of study, developed exclusive alloys, pioneered in methods of quality control. The amazing records of safety and long service life achieved by Lunkenheimer steel valves are evidence that there *is* no real equivalent for Lunkenheimer metal quality. In workmanship, too, the famous Lunkenheimer tradition of care and precision has never been equalled. New machines (most of Lunkenheimer's machinery is less than three years old) are making possible *even higher* standards of workmanship. The *only* equivalent to a Lunkenheimer steel valve is another of the same design —a Lunkenheimer. For the address of your nearest representative, and for more steel valve data, write to The Lunkenheimer Co., P. O. Box 360A, Cincinnati 14, Ohio.

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LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

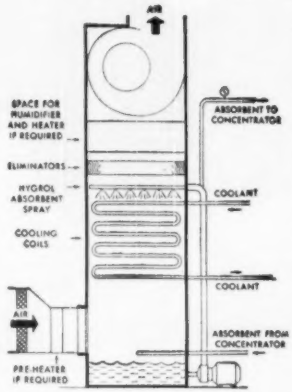
L-950-9 A

How You Save with the NEW Niagara Method of Air Conditioning

Using "Hygrol" Hygienic Absorbent Liquid

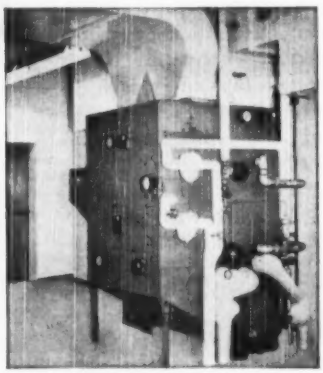
Because it absorbs moisture from the air directly, the new Niagara Controlled Humidity Method uses less, or no, mechanical refrigeration for dehumidifying. You save first costs and installing of heavy machinery. You save space, maintenance expense, power. You get easier, more convenient operation.

Using "Hygrol" hygienic absorbent liquid, this method gives complete control of temperature and relative humidity. Especially, it is a better way to obtain dry air for drying processes, packaging hygroscopic materials, preventing moisture damage to metals, and obtaining better quality for chemical process products and food products—or in obtaining better results in comfort air conditioning for office or laboratory at lower refrigeration costs.



NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

Food Packaging under Controlled Humidity


Niagara Controlled Humidity Air Conditioner

The diagram shows how filtered air is dehumidified by passing thru a spray of "Hygrol"—a liquid absorbent which removes air-borne moisture. This liquid is hygienic and non-corrosive; it contains no salts or solids to precipitate and cause maintenance troubles. It is continuously re-concentrated at the same rate at which it absorbs moisture, providing always the full capacity of the air conditioner, automatically.

Units provide a range of capacities from 1000 to 20,000 C. F. M. Multiple unit installations are in use successfully. Records of results are available. For further information, write Niagara Blower Co., Dept. P, 405 Lexington Ave., New York 17, N. Y.

(Advertisement)

stainless steel, Inconel, S-590, monel, alloy steels, tool steels, carbon and special stainless steels. Joint to be brazed is prepared the same as for copper brazing. Joint clearance should not be over 0.002 in. for highest-quality joints.
Wall Colmony Corp, 19345 John R St, Detroit 3, Mich.

PROBE VIBROSCOPE P1038

Vibrometer Model-P is hand instrument of probe type for vibration testing of turbines, generators, motors, fans, pumps and other high-speed machinery. It may be used in shop or field testing.

Two models are available. One magnifies vibratory motion 250 times, the other 125 times. Each is fitted with an 8-in. detachable probe. Measurements are taken directly on surface of rotating shaft.
The Vibroscope Co, 6 E 39th St, New York 16, N. Y.

INDUSTRIAL HEATER P1029

Self-contained, direct-fired industrial heaters are new additions to company's Thermobloc line. New models, called *Thermopac*, are made in 100,000 and 200,000 Btu per hr output, for either gas or oil firing, with thermostatic control and completely automatic operation. Units may be floor set, wall hung or horizontally suspended.
Thermobloc Div, Prat-Daniel Corp, Port Chester, Conn.

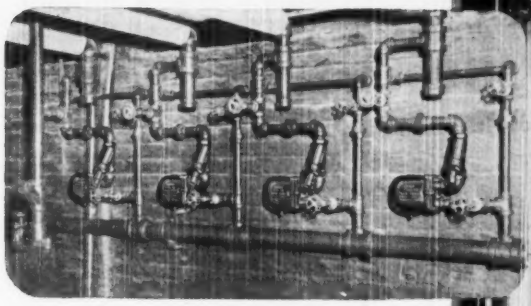
RECIRCULATING PUMP P1011

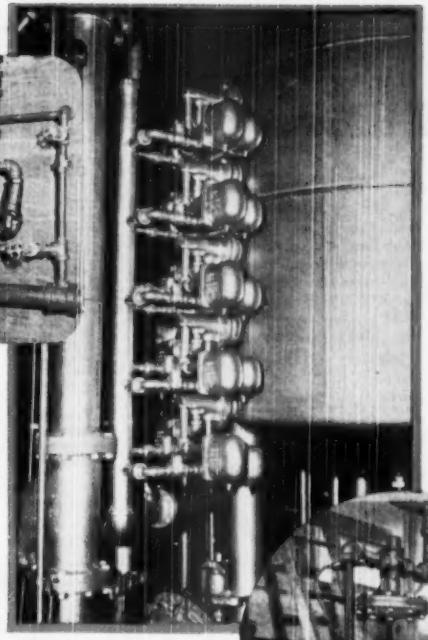
A small recir-culating pump has a double-blade molded-rubber nonclogging impeller. It can deliver 8 gpm at 2-ft head and 3 gpm at 10-ft head and is driven by a shaded-pole 110-v, 60-cycle 1/50 or 1/30 hp ac motor. Pump mounts directly on motor.
Samuel S Gelber Co, 162 N Clinton St, Chicago 6, Ill.

GAS MASK WITH PHONE P1073

Direct telephone contact between wearers of gas masks is possible with the *Maskfone*,

First we make sure of hot, dry steam at the inlet.

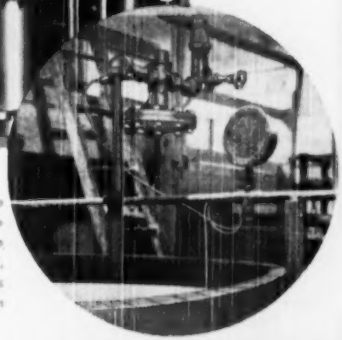




Then we select the best of four distinct types of steam traps to remove all condensate without steam waste.

GET YOUR STEAM SYSTEM *Rationalized* WITH SARCO

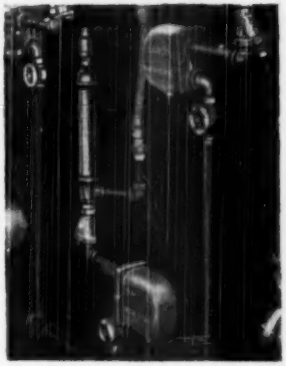
If automatic temperature control is indicated, Sarco can choose from a wide range of self-operated, pilot or electric controls to do the job at minimum cost.



Operating a steam process with maximum efficiency is more than buying a few steam traps and air vents—it is more than haphazardly applying a few temperature controls.

If it means dollars to you in increased production, improved quality and fewer rejects—it will pay you to let the Sarco man near you make a survey of your needs.

He will come up with definite, practical suggestions of how you can do a better job and save steam besides. Write today—there is no obligation.



The new Sarco draining and venting system for dry cans will save at least 20% warm-up time.

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SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

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SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

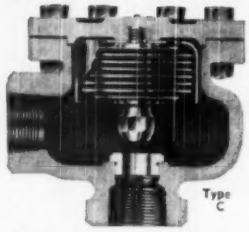
NICHOLSON TRAPS

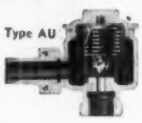
UP STEAM FLOW 50%

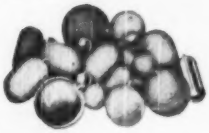
for Leading Processor

A striking increase in steam flow from 2000 to 3000 lbs. an hour is reported by a chemical maker who recently replaced a mechanical trap with Nicholsons. This cut cooking time from 105 to 55 min., a gratifying speed up of 48%. Also widely recommended for their effective venting of non-condensible gases in critical applications.

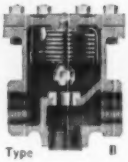
5 TYPES FOR EVERY PURPOSE—process, heat, power; size ¼" to 2"; press. to 225 lbs. **BULLETIN 450**



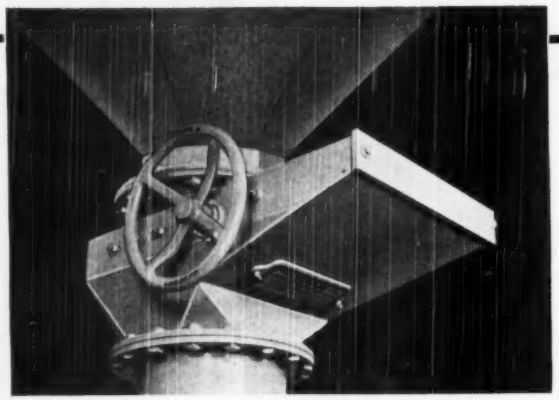




HIGH-PRESSURE FLOATS — Stainless, monel, plated steel. Welded. All sizes and shapes; for operating mechanisms and as vessels. 2-day delivery. **BULLETIN 348**



W. H. NICHOLSON & CO., 125 Oregon St., Wilkes-Barre, Pa.



S-E-CO. COAL VALVES open and close with little effort because the gates of these valves are supported on roller bearing rollers and because the shafts are also equipped with roller bearings. Suitable dust seals prevent coal dust and moisture from entering bearings. If you want a coal valve that always rolls easily, a S-E-Co. Valve is your answer.

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STOCK EQUIPMENT COMPANY
715P Hanna Building ★ Cleveland 15, Ohio

powered solely by the speaker's voice. It requires no batteries or other external power source.

Complete assembly includes transmitter, earphones with head harness, hand sets, and 125 ft of cable on a revolving reel. It is adapted for use with all M-S-A respiratory protective equipment using *All-Vision Facepiece* when equipped with the company's *Cleartone* speaking diaphragm.

Mine Safety Appliances Co, Braddock, Thomas and Meade St, Pittsburgh 8, Pa.

HEAT-TREATING FURNACE P1015

Well-insulated, heat-treating furnace ranging from 1.8 to 20 cu ft for precision heating of products up to 2500 F. Outside temperature is said to stay at or below 150 F at height of operation.

This furnace is equipped with porcelain-protected thermocouples and direct-reading pyrometers with calibrated energy input and atmosphere proportioning. A patented forced-draft burner is included for natural gas, manufactured or liquid petroleum gases.

A D Alpine, Inc, 11837 Teale St, Culver City, Calif.

LEATHER-FABRIC BELT P1014

Combines nonstretching advantages of fabric belting and high pulley-grip of leather. It is reinforced with synthetic cords cemented between two leather plies by a special process. This cord prevents leather under load stretching beyond a certain amount and returns the belt to its true length when unloaded. Available in widths up to 24 in. this belt can be obtained endless or with laps prepared, or it can be installed with hooks.

S R Sikes Co, Dept P, 1028 S 3rd St, Minneapolis 15, Minn.

HEAVY-DUTY FLOODLIGHT P1076

Type CA is a 250-watt floodlight designed for applications requiring a rugged unit to produce a narrow beam spread. Body and door frame are each cast in one piece of aluminum. Graphetized asbestos gaskets are used to seal joints between lens and door frame, and between door frame and body.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

CAST-STEEL VALVES P1054

Small-size high-pressure cast-steel valves are designed for service like high-pressure steam, boiler feedwater, bypass, instrument and throttling. Valves are available in globe, angle and Y patterns. Classes 1500 and 2500 lb. Sizes range from ½ to 2 in. Valves have socket weld ends.

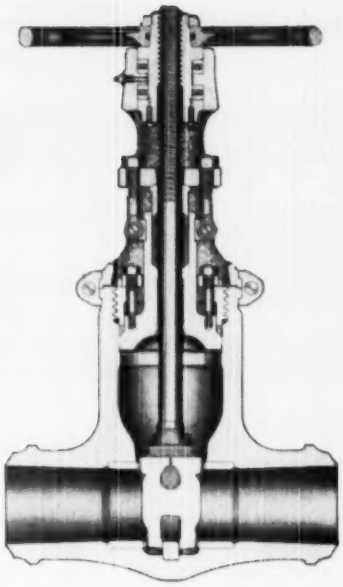
Body and bonnet are of one-piece construction, seats and disks are hard-faced stellite.

The Wm Powell Co, 2503-31 Spring Grove Ave, Cincinnati 22, Ohio

ELECTRICAL HEATING P1072

An electrical-conducting coating on the surface of heat-resistance glass results in a heating element that can be made to cover

ANOTHER PROVED PERFORMER IN THE COMPLETE CRANE LINE



Pressure-Seal Bonnet
Cast Steel Wedge Gate
600, 900, and 1500-Pound

PRESSURE-SEAL BONNET VALVES FOR HIGH-PRESSURE, HIGH-TEMPERATURE PIPING

Crane Pressure-Seal Bonnet Valves are without question the greatest valve "buy" for high-pressure power plants today. They represent a revolutionary change in the design and construction of valves used to control high pressure-temperature steam and water. Check the features below . . . see why Crane Pressure-Seal Valves are approved and preferred by the nation's leading power engineers.

NO BONNET JOINT LEAKAGE—NO BONNET JOINT MAINTENANCE—Crane Pressure-Seal design completely eliminates the major problems of conventional valves in holding high pressures and temperatures. Once joint is made tight, it automatically stays tight.

AMAZING WEIGHT SAVINGS—Permit substantial reduction in piping erection costs. Larger size 1500-Pound Gates are as much as 60% lighter than conventional valves of this class.

REDUCED OVERALL DIMENSIONS—Unusual compactness permits close nesting of valves where necessary; less head room is required.

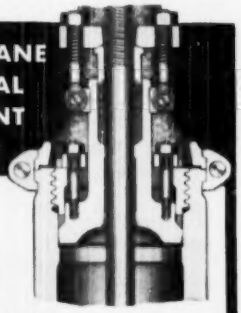
BETTER FLOW CHARACTERISTICS—Exhaustive on-the-job tests show minimum pressure drop and turbulence in globes, angles, and stop-checks; straight-through flow in gates.

STREAMLINED BODY—No abrupt changes in metal thickness. No areas where acute stresses might concentrate. Easy to insulate.

SEND FOR THIS NEW CIRCULAR
Contains complete information about these outstanding valves—including all essential specification data, service recommendations, and list prices. Ask your Crane Representative for your copy; or **WRITE FOR CIRCULAR AD-1819.**

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

HOW THE CRANE PRESSURE-SEAL BONNET JOINT OPERATES



Bonnet joint is inside the valve . . . sealed with a wedge-shaped seal ring. Internal fluid pressure acting upon entire underside of bonnet *reacts* upon smaller contact area of seal ring. Leakage is impossible because sealing pressure is always greater than pressure of line fluids. The higher the internal pressure, the greater the sealing pressure.

Angle Stop-Check
900 and 1500-Pound
Sizes: 6 to 12 inch

Globe Valve 900
and 1500-Pound
Sizes: 2 to 12 inch

EVERYTHING FOR EVERY PIPING SYSTEM

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VALVES • FITTINGS • PIPE • PLUMBING AND HEATING

If you're designing, installing, or modernizing
a power plant of 100 developed HP upward

you can
SAVE TIME
MONEY
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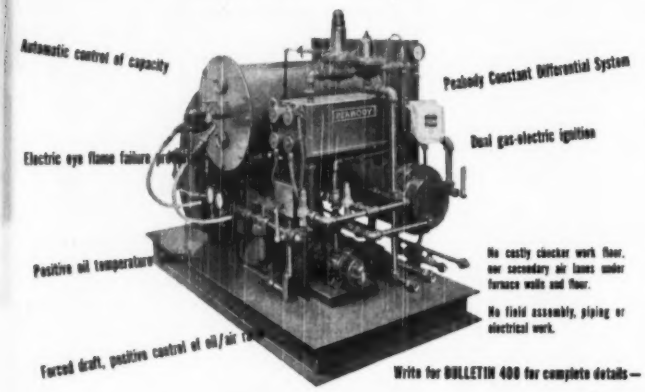
PEABODY Automatic Burner

HERE'S WHY — The Peabody Automatic Burner is a complete compact oil-combustion system that takes heavy Bunker "C" oil (or lighter) from the storage tank, preheats it, pumps it to required pressure, delivers it to the burner at proper viscosity, ignites it, and then burns it at the proper firing rate. The entire unit is mounted on a common base at the factory. No other construction or engineering necessary beyond connecting to service lines. It *eliminates all other auxiliary equipment* and gives you dependable, low-cost combustion. The Peabody Automatic Burner is listed by Underwriter's Laboratories and is available for both automatic and semi-automatic operation.

CHECK THESE FEATURES—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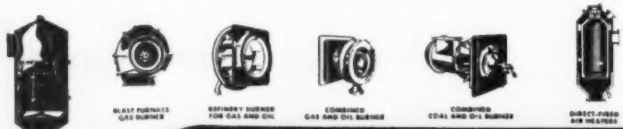
Peabody Constant Differential System
Dual gas-electric ignition
No costly checker work flues, use secondary air lanes under furnace walls and floor.
No field assembly, piping or electrical work.
Write for BULLETIN 408 for complete details—



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580 FIFTH AVENUE • NEW YORK 19, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers

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a large area or unusual shape. Elements can range from a low to a high transparency for transmission of visible light, according to application needs. Units are designed for 110-v and 230-v ac operation.

These units are high-efficiency radiant heaters. In flat sheet form, they are called *Pyrex EC* radiant panels and may be used for industrial baking and drying. Panels can have power outputs as high as 1500 watts per sq ft for operation in free air.

Corning Glass Works, Corning, N. Y.

MOTOR STARTER P1078

This starter incorporates an under-voltage protective system, allowing the starter to remain locked in on voltage dips. It allows the motor to re-accelerate if voltage recovers within two seconds or less.

There is no physical change in the starter-contactor assembly; only the pushbutton control circuit is revised to include capacitance in the coil circuit for a short period after the contactor closes. A small timing relay keeps pushbutton coil circuit alive up to two seconds to allow the motor to restart on voltage return.

The Electric Controller & Mfg Co, 2700 E 79th St, Cleveland 4, Ohio

SMOKE INDICATOR P1070

This device indicates smoke density when a power plant starts, and signals when this density exceeds a predetermined value. Unit consists of three basic components: light source, photoelectric scanner, and control and indicator combined in a single housing.

Light source and scanner are mounted on opposite sides of stack while indicator is placed in a convenient location, as on control panel. Red and green jewel lights in the indicator show excessive or efficient smoke conditions. Units operate up to a maximum distance of 20 ft between light source and scanner.

Combustion Control Corp, 77 Broadway, Cambridge 42, Mass.

VIBRATING CONVEYOR P1007

A vibrating machine uses mechanical operation to produce vibrating motion. A drive unit with eccentrics is mounted in the end of one section with connecting

Call in this Remarkable Instrument

TO INCREASE
POWER OUTPUT AT NO INCREASE IN COST

THE Cities Service Industrial Heat Prover is a flue gas analyzer which quickly, accurately and completely determines the heat generating efficiency of equipment using any type of fuel. With this information necessary adjustments to increase efficiency can be made.

A complete new line of petroleum products for the power field including:

- **D-C Diesel Engine Oils**
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The Heat Prover gives you the answers to these questions important to efficient production:

1. **How much energy is wasted in uselessly heating excess air?**
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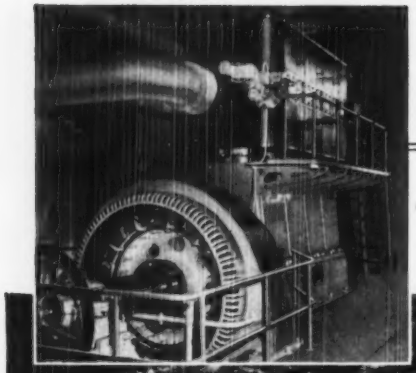
*City*_____ *State*_____

6 SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES



Engine room view of a Skinner 4-Cylinder Vertical "Universal Unaflow" Steam Engine at Bassett Furniture Company, Inc., Bassett, Va.

provide economical power for BASSETT FURNITURE INDUSTRIES, INC.

Bassett Furniture Industries, Inc., operates five plants in Henry County, Virginia. Three of these plants produce finished bedroom and dining room furniture and the other two furnish the accessories. The Bassett name is known to every furniture buyer in the United States.

In each of the three modern plants manufacturing furniture, power is generated by two four-cylinder vertical Skinner "Universal Unaflow" Steam Engines, directly connected to 1250-kw. alternating current generators. Exhaust steam is used for heat and for manufacturing processes.

Bassett Furniture Industries is one of many furniture and woodworking manufacturers which, with hundreds of dairies, breweries, laundries, hotels, hospitals, schools, and institutions, have found a double economy in using Skinner "Universal Unaflow" Steam Engines for the generation of power and the exhaust steam for processing, hot water generation and space heating.

Our engineers are prepared to make accurate estimates, which may prove you can produce dependable power in your plant at a fraction of the cost of purchased power. Write for detailed information about the advantages of Skinner "Universal Unaflow" Engines in your field.

For Over 80 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

rods to the adjacent end of the other section. Drive unit alternately draws the pan-sections together and forces them apart several hundred times per minute.

This machine conveys practically any substance in almost any form or condition. It operates horizontally, downhill or uphill to 10 deg depending on nature of material and load depth. It conveys a full pan load at 30 to 40 ft per min. These conveyors come in several widths and in lengths up to 200 ft for operation from one vibrator. Bulletin No. 135.

Robins Conveyors Div, Hewitt-Robins, Inc, 270 Passaic Ave, Passaic, N. J.

DRILL PRESS P1024

Adjustable-feed handle and one-piece head casting feature new, low-priced 14-in. bench or floor-drill press known as *Economy Model*. Automatic belt-tension device maintains proper tension on motor belt. Spring tension helps absorb shock if drill catches in the work. General specifications are capacity to drill to center of 14¼-in. circle, maximum drill size ½-in. in steel, spindle run-out, 0.005 in., spindle square to table within 0.0075 in. in 5 in.

South Bend Lathe Works, 425 East Madison St, South Bend 22, Ind.

PROPELLER FANS P1051

The *Aeromaster* fan is applicable to engine jacket-water coolers, vertical air-discharge condensing units, large air-conditioning systems and various air and water coolers. Diameters range from 6 to 20 ft. Maximum capacity is 500,000 cfm for the 20-ft-diameter fan.

Blade core is laminated birch bonded with resins. Wood is splayed at alternate angles for torsional strength. Plastic covering is applied to birch to protect it from weather and abrasion.

Koppers Co, Inc, Pittsburgh 19, Pa.

MOBILE TOOL CABINET P1064

Easy-to-move drawer runners fit into notches spaced every 2-in. from top to bottom. This design permits any of three basic sizes of drawers, 2, 4 and 6 in. deep to be installed in the new *Proto Toolmobile*.

The cabinet, No. 9968, mounted on 5 in. rubber casters, is constructed of heavy gage welded steel. It has rounded corners, extra heavy bottom channels, double side walls. Roller slots keep drawers from sliding open when cabinet is moving.

Plomb Tool Co, Washington and Sante Fe, Los Angeles 54, Calif.

PIPE THREADER P1020

Self-contained pipe threader, the *Ridgid* 65R, is now made jamproof. This means it does not need to be watched while threading pipe by hand or power because a new-design drive plate automatically kicks out the driving ratchet pawl when standard-length thread is cut. It is available in two sizes: 2½ by 2⅞ in. deep and 1½ by 1¾ in. deep.

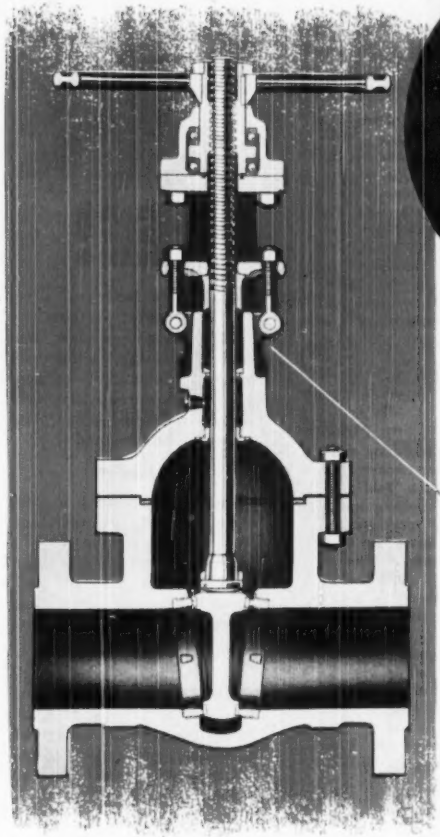
Ridge Tool Co, Elyria, Ohio

MOTOR-DRIVEN TROLLEY P1006

Designed for connection to standard lug-mounted electric hoists this motor-driven

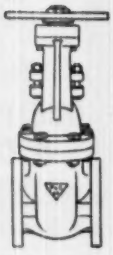
You'll benefit by using

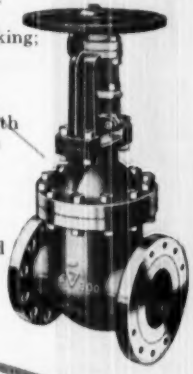
R·P&C
CAST STEEL VALVES



Note the **quality features** of this Gate Valve. They are typical of all valves in the R-P&C Cast Steel Line—gate, globe, angle and check valves in pressure classes 150 lb. through 1500 lb.

- **Ball Bearing Operating Nut** permits smooth operation with minimum effort.
- **One Piece Yoke with Cap** provides rigidity, perfect alignment and easy access to operating nut.
- **High Quality Packing** assures a tight stuffing box under all conditions—low stem friction—minimum servicing.
- **Gland and Follower with Ball Joint** applies uniform pressure on packing, prevents follower binding with stem.
- **Heat-treated Stainless Steel Stem** has high strength and corrosion resistance. Polished surface increases life of packing; T-head makes strong, self-aligning connection with wedge.
- **Solid I-Beam Wedge** is guided to proper seating by guide ribs cast integral with the body. Wedge seating surfaces are precision ground to fit perfectly with body seat rings.
- **Barrel-type Seat Rings** have heavy, uniform section; offer no points of high stress concentration; have broad seating surface, ground smooth for less wear—longer life. Port opening is full pipe diameter.





***In addition** to the standard line, R-P&C offers cast steel gate and globe valves with Pressure Sealed Bonnet joint—especially adapted for high pressure, high temperature service. For information, get in touch with your nearest R-P&C District Office.*

ACCO Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Connecticut

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

READING-PRATT & CADY VALVES

"GUNITE" Concrete

(SINCE 1918)

Linings for

STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
UPTAKES •
BREECHINGS •

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STEEL & PIPE ENCASEMENT

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FIREPROOFING •

GUNITE CONCRETE & CONST. CO.

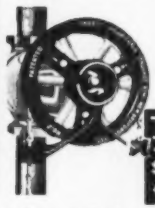
1301 Woodswether Road
KANSAS CITY 6, MO.

R. M. Turner, Dist. Mgr., 228 No. La Salle St., Chicago 1, Ill. B. H. Nuoline, Distr. Mgr., 6625 Delmar Blvd., University City, (St. Louis), Mo. Philip D. Barnard, Distr. Mgr., 2008 Addison, Houston 5, Tex.

Branch Offices: New Orleans, Dallas, Denver.

"See our catalog in Sweet's"

SOLVED! An Overhead PIPING PROBLEM



• Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

• Operation of valves in overhead piping is no longer a problem. Put valves where they should be, where they'll be most economical or efficient, even if necessary to place them out of reach. Easy, safe, positive control is provided by the BABBITT Adjustable Sprocket Rim with Chain Guide—right from the floor!

• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

trolley may be adjusted for a wide range of beam sizes. It has crown-tread machine steel wheels with hardened drivers. Each wheel has a double-row precision ball bearing and a removable-head axle fitted with grease fittings. Trolley is powered by a crane-duty, high-torque, totally enclosed, 30-min, 55-deg rated motor. Magnetic contact panel has a transformer to reduce the voltage in the single-speed pushbutton control circuit. A 4-button control station operates the single-speed trolley and hoist motions. Catalog available.
Industrial Equipment Co, 315 N Ada St, Chicago 7, Ill.

UNIT CONDITIONER P1036

Steel-constructed cabinet, insulated with ½-in. layer of rock wool, houses a unit air conditioner, Model 520, equipped with 2-cylinder 5-hp compressor plus a condenser-receiver in rear of cabinet.

Air enters the conditioner through inlet grilles, recirculated air in center and fresh air at back or one side. Both air streams pass through filters, which are washed by condensed water falling from the cooling coils. The cleaned air then passes over the cooling coils and into a blower where it is discharged through the grilles at top of unit.
Frick Co, Waynesboro, Pa.

AIR PURIFIER P1065

Hymatic unit combines a reducing valve and compressed air filter for removing oil and water. Valve can be set to hold pressure over a wide range, supplying up to three average-size industrial spray guns.

Unit carries the high-pressure air to a centrifugal-like separation stage. Then at reduced velocity the air is carried to a scrubbing medium, from whence it is delivered clean and dry at the reducing valve or high-pressure element.

Units are available to handle pressures up to 200 psi at inlet. Outlet pressure is variable up to within 20 psi of inlet figure. Pressure drop through unit is about 5 to 10 psi, depending on flow.
The Hymatic Engineering Co, Ltd, 6-10 Whitfield St, London W. 1, England.

INDUSTRIAL HAND HOIST P1012

A hand-operated hoist or puller weighs 9½ lb, requires less than 1-ft space but has a capacity of 1000 lb on any lifting or pulling load. Unit is useful on general shop maintenance and construction for lifting parts and holding them in place while being welded, for installing equipment, loading and unloading trucks, and many other lifting jobs.
Coffing Hoist Co, Danville, Ill.

PIPE PLUGS P1050

Dryseal pipe plugs are alloy steel, brass and aluminum. Sizes range from 1/16 to 2 in. Plugs are interchangeable with Briggs-type pipe threads. These plugs are designed for a positive seal. Metal-to-metal contact is obtained by a truncation of the major diameter of the internal thread and a

FREE!

NO more laborious, time-consuming scraping or sand-blasting — no more danger of damaged equipment, stripping failures. Now simplify your paint-stripping with designed-for-the-job Oakite materials and methods.

Fast!

Oakite paint-strippers applied by steam gun, cold spray, or hot flow-on method (to fit your plant) quickly break the bond between paint and surfaces, leave surfaces in top shape for repair and repainting.

Low-Cost!

Oakite paint-stripping costs less because it cuts days off stripping time . . . because even small quantities of material in solution pack plenty of stripping power.

Get Details!

FREE illustrated booklet "How to Strip Paint" sent on request. Write Oakite Products, Inc., 23 Thames St., New York 6, N. Y. No obligation.

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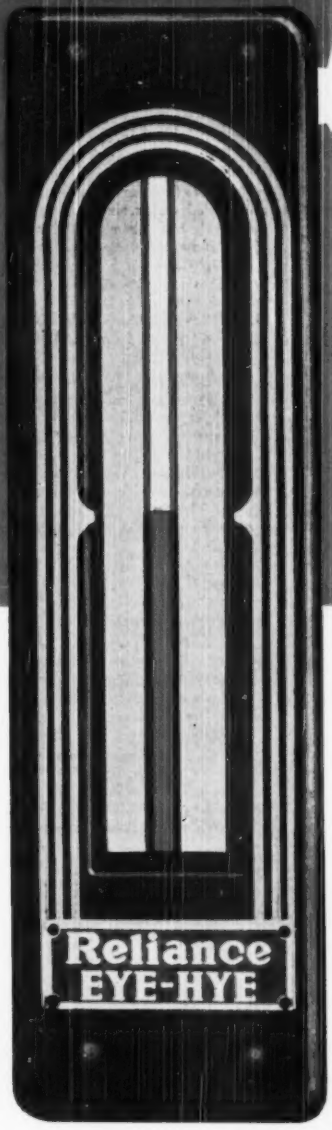
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada



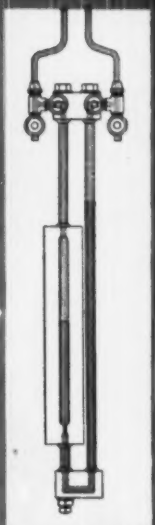
It's EYE-HYE

...that gives you a true

"liquid column"

water level reading

remote from the boiler

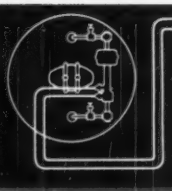


Easy to Install
Easy to Read
Easy to Maintain

The easiest, most natural way to read boiler water levels is in *liquid* fluctuating between two points that show high and low danger limits. Reliance EYE-HYE Remote Reading Gage brings gage reading to convenient eye-height position—shows water level clearly in illuminated green liquid. EYE-HYE is accurate—sensitive to slight level changes. Reading EYE-HYE is accurate, too. You get its message at a glance—*faster* even than you can see dull-colored water in the usual gage.

EYE-HYE is all-hydrostatic—has no mechanical parts. It's easy to install—easy to read—needs practically no maintenance. *Write for Catalog CO.*

The Reliance Gauge Column Co. • 5902 Carnegie Avenue, Cleveland 3, Ohio

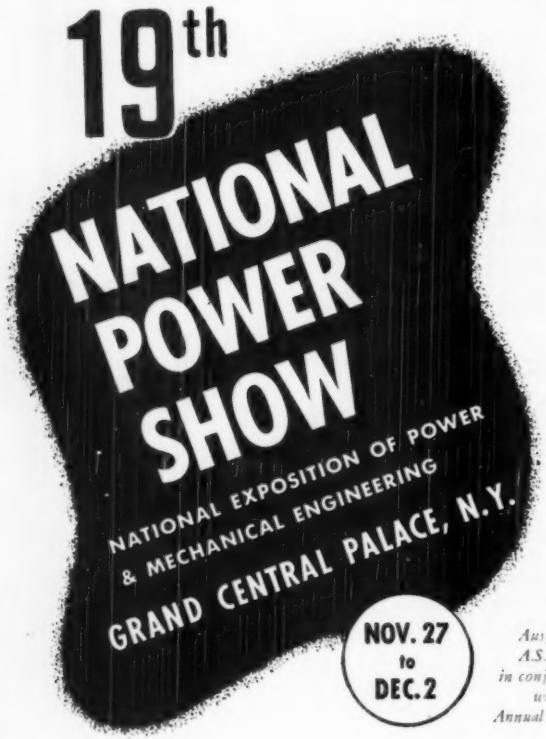


Reliance EYE-HYE
Remote Reading Gage

All-hydrostatic • Reads like a tubular glass gage

Outstanding Opportunity!

A wealth of new and practical cost-saving ideas awaits YOU at this foremost display of steam, electric, and mechanical power equipment. . . .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NATIONAL POWER SHOW
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GRAND CENTRAL PALACE, N.Y.
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SEE over 300 informative exhibits and demonstrations of latest techniques, equipment, and supplies for more efficient power production, mechanical transmission, and utilization, materials handling, and plant services.

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Management International Exposition Co.

truncation of the minor diameter of the external thread.
U. S. Plug & Fittings Co, 305 Frederick Bldg, Cleveland 15, Ohio

GLASS FIBER TUBES AND PIPES **P1055**

Designed as a replacement of steel and other critical war materials, this glass-fiber pipe is resistant to many dilute and strong acids. *Glassweld* is a laminated tubing in which glass fibers in cloth, mat or tape form are bonded with resins to form a tube impervious to heat, chemical action and strong blows. It has good electrical properties, is lightweight and has a high-strength factor. The tubes are also suitable for electrical and structural work
U. S. Plywood Corp, Weldwood Bldg, 55 W 44th St, New York 18, N. Y.

GAS BURNER **P1030**

Positive ignition and flame retention are claimed for series of line burners for natural, propane, butane or manufactured gas mixed with air by any conventional gas-air mixing equipment. Various-shaped sections and lengths provide any required flame pattern. They come in grey iron for capacities from 10,000 to 80,000 Btu per ft of burner length.
Vapofire Corp, 10316 S Throop St, Chicago 43, Ill.

VIBRATING FEEDER **P1008**

This feeder conveyor is mechanically operated and requires no electrical accessories other than a plug receptacle. It consists of a motor-driven eccentric shaft running in four bearings and can operate horizontally, downhill or slightly uphill depending on nature of material and depth of load. Sizes range from 24 to 48 in. wide, are 4 to 8 ft long. Catalog No. 134.
Robins Conveyors Div, Hewitt-Robins, Inc, 270 Passaic Ave, Passaic, N. J.

CONTROL DRIVE **P1066**

An air-operated drive coupled with a positioning relay and specially-shaped cams makes posible a paralleling of all driven units working on a process. For instance, fans, boiler-feed pump, stoker or other fuel-burning equipment on a boiler.

A double-acting air cylinder, either 6x8-in. for torque requirements of 280 to 400 ft lb or a 8x16-in. size for torques up to 1500 ft lb, relates air pressure to the different drives.
Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio

AIR GRILLE **P1067**

Fixed fin, *Uni-Flow*, Model EF supply grille for ventilating or air conditioning. Fixture has a large free area for low noise level and minimum pressure drop. Available in a wide range of sizes.
Barber Colman Co, Rockford, Ill.

TRACTOR **P1068**

Speedy, rubber-tired, four-wheeled tractor dozer, about 3500 lbs lighter than the standard, the *Super D Tournadozer* meets need for smaller unit. It is powered by a 122-hp diesel. Its capacity is 1.8 yards.
R G LeTourneau Inc, Peoria, Ill.

PLANT EQUIPMENT NEWS

Reader Service Page for New Products and Literature

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

BOILERS AND AUXILIARIES

B11 **OIL BURNER**—4-page folder No. 175-D describes horizontal rotary oil burner. Detailed explanation is given of dual pump reservoir, the patented "Voluvalve" fuel regulator, high-speed belt drive, and other important engineering features. Preferred Utilities Mfg Corp, 1869 Broadway, New York 23, N. Y.

B12 **CHAIN GRATE STOKERS** — 4-page bulletin No. 5010MC discusses features of heavy duty forced draft chain grate stokers. 8 diagrams of open furnace installations showing various boiler types are included. Laclede Stoker Co, 4438 Hunt Ave, St. Louis 10, Mo.

B13 **FEEDWATER CONTROL**—8-page booklet No. S-52 describes and illustrates the Republic single, double and triple element boiler feedwater control system. A comparison of the 3 systems and advantages of each are listed. Republic Flow Meters Co, 2240 Diversey Pkwy, Chicago 47, Ill.

B14 **REFRACTORIES** — Single-sheet gives information on special shape refractories. Also contains photographs of production operations and some of the special shapes. Ironton Fire Brick Co, Ironton, Ohio.

B15 **OVERFEED STOKERS** — 16-page catalog No. 501 covers the Stowe stoker's design and operating features in detail, including a cut-away sectional view showing the type of fuel bed it produces. Stowe Stoker Div, Johnston & Jennings Co, 877 Addison Rd, Cleveland 3, Ohio.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **OVER-FIRE AIR**—8-page folder gives description and technical information on new Turbo-Air system designed for maintaining maximum combustion of coal fuels, and elimination of a smoke nuisance by over-fire air. Canton Stoker Co, Canton, Ohio.

B16 **STOKERS** — 4-page bulletin No. 501 features stokers for any steam generator including package types. Illustrations are given of the firm's Lostoker, Unistoker, Rotostoker, Rotograte and double retort stoker. Detroit Stoker Co, General Motors Bldg, Detroit 2, Mich.

ELECTRICAL EQUIPMENT

F19 **POWER CABLE**—Booklet No. 15-150 discusses GE's Super Coronol-Geoprene power cable for circuits up to and including 15,000 volts. Charts and tables on physical and electrical properties, splicing and terminating instructions, specification data, and application recommendations are given. Construction Materials Dept, General Electric Co, Bridgeport 2, Conn.

F20 **MOTORS AND GENERATORS**—16-page bulletin No. 2-200 presents an overall view of EP custom-built equipment for industry. Featured are: ac motors and generators; dc motors and generators; motor-generators; frequency changers; battery chargers; and electrolytic power supplies. Electric Products Co, 1725 Clarkstone Rd, Cleveland 12 Ohio.

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

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POWER, 330 West 42nd St., New York 18, N. Y.

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Address
Your Name
Your Title

POWER, 330 West 42nd St., New York 18, N. Y. 10/50

F21 VARIABLE TRANSFORMERS — 16-page catalog P550 describes in detail both manually operated and motor-driven Powerstat variable transformers and line correctors. Also included is data on Voltbox ac power supplies, oil-cooled Powerstats and explosion-proof Powerstats. Superior Electric Co, Bristol, Conn.

F22 ELECTRICAL INSULATION — 8-page manual gives details on Glastic MX, a fiberglas-reinforced alkyd base, polyester laminate for electrical insulation. Mechanical and electrical properties are listed. Laminated Plastics, Inc, 1333 E 40th St, Cleveland 3, Ohio.

F23 STANDBY POWER—4-page leaflet No. A-277 tells how any business, factory, institution, etc, can be protected against property damage and production losses by using standby electric plants. D W Onan & Sons Inc, 43 Royalston Ave, Minneapolis 5, Minn.

F24 AMPLIFIERS — 8-page catalog No. 550 features photo-electric amplifiers for smoke control, fire detection, production line control, inspection, warning devices and many other industrial applications. Several models are illustrated. De-Tec-Tronic Labs Inc, Dept C, 1317 N Clark St, Chicago 10, Ill.

F25 SOLDERLESS CONNECTORS—4-page folder No. 750 contains detailed descriptive data on the firm's line of "pres-Sure-connectors" for solderless splicing and terminating of electrical wires. Installation instructions and ordering information are also given. Buchanan Electrical Products Corp, 1290 Central Ave, Hillside, N. J.

F26 CIRCUIT BREAKERS — 12-page bulletin No. 5410 presents fully magnetic non-thermal, non-enclosed, general purpose circuit breakers. Illustrations, charts, diagrams, graphs and cut-away views portray the Heinemann line of 1-, 2-, and 3-pole breakers for general industrial use. Heinemann Electric Co, Trenton 6, N. J.

MAINTENANCE MATERIALS

L19 DIESEL LUBRICATION—20-page booklet, entitled "Standard HD Diesel Oil," tells about a superior heavy-duty diesel lubricating oil specifically developed and marketed for use in railway and industrial diesel engines. Advantages, applications and service suggestions are listed. Standard Oil Co (Indiana), 910 S Michigan Ave, Chicago 80, Ill.

L20 SLUDGE REMOVER — 4-page leaflet explains Syn-Solv, a fuel oil additive for keeping tanks, pipe lines, strainers and nozzles clean. Also removes sludge from fuel oil systems and prevents the formation of sludge when added to fuel oil. Henry E Sanson & Sons, 145 Quaker Ridge Rd, Manhasset, L. I., N. Y.

L21 ANTI-CORROSION TAPE—4-page brochure describes use of "Scotch" brand electrical tape No. 22 to protect pipelines against corrosion by water, salt water, acids, alkalies and soils. Tape is recommended for use on pipes 3 to 36 in. in diameter, either above or below ground. Minnesota Mining & Mfg Co, 900 Fauquier St, St. Paul 6, Minn.

L22 ADHESIVES—8-page catalog section No. 5140 features a table which lists by number each adhesive that the firm manufactures, the materials for which they are specifically recommended and the method by which the most effective bond is created. B F Goodrich Co, Akron, Ohio.

L23 RETAINING RINGS — 8-page booklet No. 4K-W describes complete line of Waldes Truarc retaining rings. New special-type rings, assembly tools, fixtures and application pliers are shown. Waldes Kohinoor Inc, 47-16 Austel Pl, Long Island City 1, N. Y.

MATERIALS HANDLING

M9 CONVEYING MACHINERY—48-page catalog No. 552 is an up-to-date revision describing the company, its subsidiaries and the products of each. Complete coverage is given to coal mining machinery, electric locomotives, chains, conveying and crushing machinery. Jeffrey Mfg Co, 932-99 N 4th St, Columbus 16, Ohio.

M10 VIBRATING FEEDER — 4-page folder No. 134 discusses the Vibra-Feeder (R), a vibrating feeder employing mechanical, rather than electro-magnetic, means of operation. Only 3 ampere-draw is required from its 1-2 hp motor. Robins Conveyors Div, Hewitt-Robins Inc, 270 Passaic Ave, Passaic, N. J.

M11 WIRE ROPE — 4-page bulletin No. 50-35 furnishes a quick reference of all information pertaining to improved plow steel wire rope. All sizes and construction classifications are combined in one large table. Macwhite Co, Adv Dept, Kenosha, Wis.

M12 VIBRATING CONVEYOR — 4-page folder No. 135 presents the Vibra-Veyor (R), a vibrating conveyor which produces balanced mechanical operation without counterweights. Simple design reduces maintenance. Robins Conveyors Div, Hewitt-Robins Inc, 270 Passaic Ave, Passaic, N. J.

MECHANICAL TRANSMISSION

N7 SPEED REDUCER — 32-page booklet No. G-WBV gives informative data on Imo-De Laval worm gear speed reducers. It covers all the latest revised AGMA hp ratings. Also lists types of speed reducers, selection tables, overhung load rating tables, dimension tables, etc. De Laval Steam Turbine Co, Trenton 2, N. J.

N8 WATER-COOLED COUPLINGS —16-page bulletin features water-cooled couplings for adjustable-speed drives from ac. Basic principles, characteristics, typical applications, and construction details are explained and illustrated. Synamtic Corp, Kenosha, Wis.

N9 VARIABLE SPEED DRIVES — 88-page book No. 2274 illustrates and describes Link-Belt PIV variable speed drives available in 8 sizes and 16 types, from ½-25 hp, with manual and automatic controls. Diagrams of automatic speed control applications and photographs showing a variety of PIV installations are included. Link-Belt Co, 307 N Michigan Blvd, Chicago 1, Ill.

N10 SPEED CONTROL—12-page bulletin No. 30B7223A covers the automatic Vari-Pitch drive, a simple, low-cost method of instant speed control covering most speed changing needs from 1½ to 40 hp. Instructions and tables are also given for figuring the components needed to assemble a drive for almost any speed range and hp within the range of this drive. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

N11 STANDARD SPEED REDUCERS —8-page bulletin No. 3901-50 consists of diagrams and rating tables

(Continued on page 192)

FIRST CLASS
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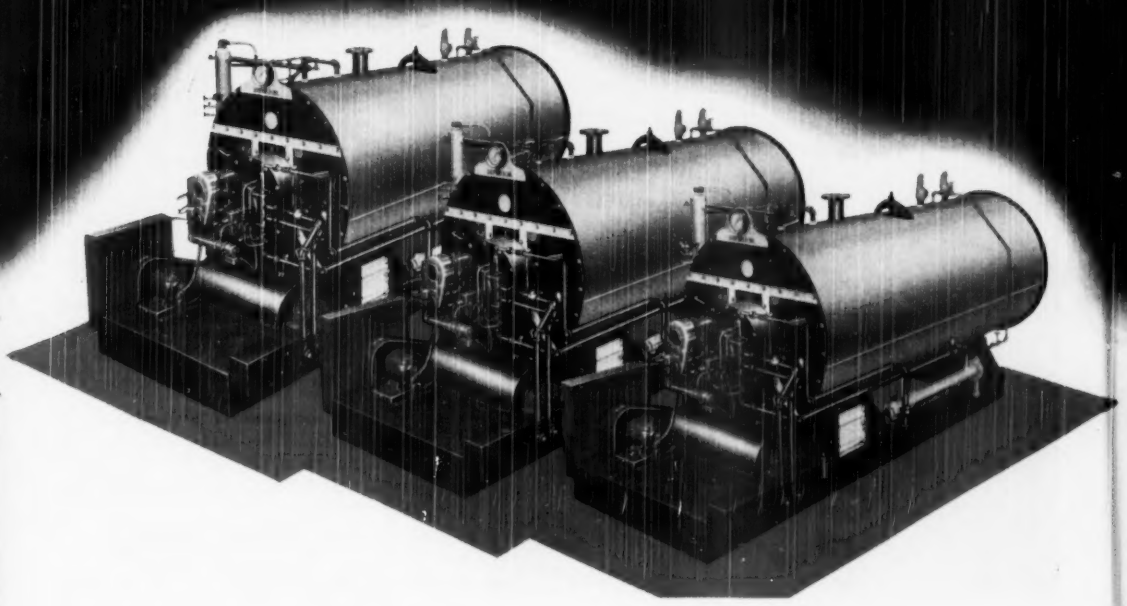
WHEN YOU'RE COUNTING

Superior STEAM GENERATORS



Battery installations of Superior Steam Generators provide extreme flexibility to meet the most widely fluctuating steam demands. A hospital installation illustrates the point.

From early June through September, steam demand is limited to the needs of hot water and sterilization. Any one of the three units carries this load with ease . . . and at higher efficiency than could be obtained by minimum operation of a larger boiler.

When cold weather adds its heating load, a second Superior Steam Generator is fired. Only the most severe weather demands firing the third unit . . . which throughout the rest of the year provides stand-by equipment which is desirable in any operation.

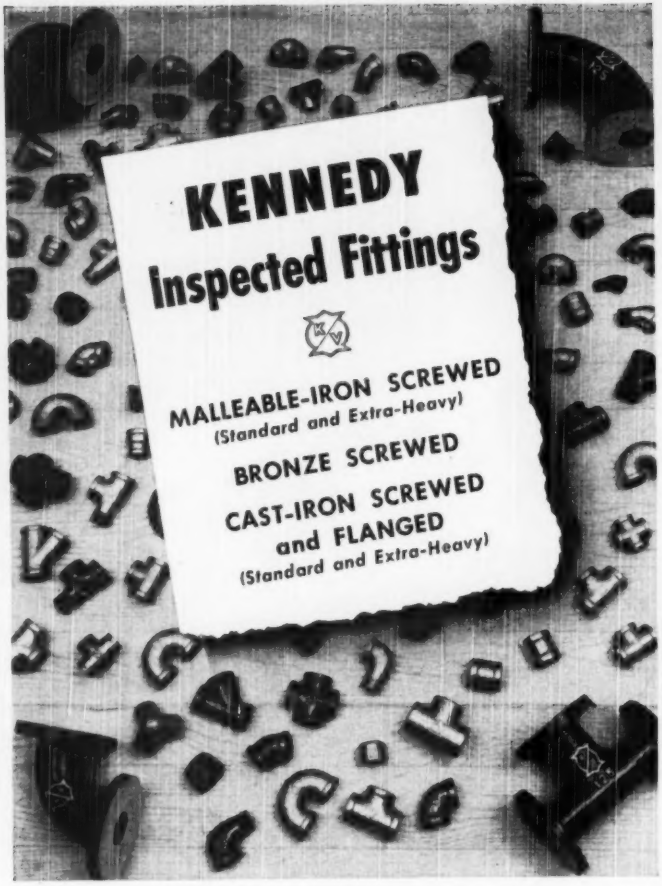
By employing different combinations of the three, (7 in all) allowing each unit in turn to share the load; all enjoy longer life at maximum efficiency . . . and by using only the number dictated by the steam demand, maximum economy at every stage of steam demand is assured.

Let us show you how battery installation can serve you better in your new plant . . . or augment your present steam facilities.

Write today for Catalog 201

Superior Combustion Industries, inc.

Factory: Emmaus, Pa.
Executive Offices: Times Tower, Times Square, New York 18, N. Y.



MALLEABLES. Standard and extra heavy. Tough close-grained iron, black or galvanized, precision threaded with generous chamfer for easy pipe entrance. Constantly checked for alignment and depth of thread . . . individually inspected to insure high quality. Hot-dip galvanized for a thoroughly bonded, heavy coating of uniform thickness. High safety factor in service rating.

BRONZE. Durable, long-lived bronze, rough or polished, precision threaded and well chamfered for easy pipe-fitting and thread protection. Individually inspected . . . *each air-tested under water.*

CAST-IRON. Flanged and screwed fittings and flanges, (Standard and extra-heavy), sprinkler and drainage fittings. KENNEDY Higher Strength Cast-Iron 50% stronger than ordinary gray iron . . . extraordinarily tough, dense and homogeneous throughout. Individually inspected. Dimensions and drilling conform to accepted standards.

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of standard speed reducers. Service factors and characteristics are also given. Cone-Drive Gears Div, Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich.

N12 **MAGNETIC CLUTCH** — 4-page folder No. 60-1 outlines company's Magneclutch control, an electrically controlled magnetic clutch. Performance data is given. Vickers Electric Div, Vickers Inc, 1815 Locust St, St. Louis 3, Mo.

METERS AND INSTRUMENTS, MECHANICAL

T13 **LIQUID LEVEL INDICATORS**—20-page catalog No. WG-1823 describes liquid level indicators and auxiliary attachments for remote indication of liquid level in boilers, feedwater heaters, storage tanks, etc. Complete construction and operation details, installation suggestions, dimensions, etc, are given. Yarnall-Waring Co, Philadelphia 18, Pa.

T14 **AIR-FLOW REGULATOR** — 4-page folder No. FH-15-3 discusses the new Cono Airpak, a packaged regulator-filter, which combines the features of a reducing-relief valve and an efficient air filter in a form ideally adapted to instrument controller requirements. Conoflow Corp, 2100 Arch St, Philadelphia 3, Pa.

T15 **RECORDING GAGE** — 32-page bulletin No. G621 consists of the company's line of Series 500 recording gages. Measuring elements, operating principles, recording charts and accessories for various types of recording gages are fully described. Bristol Co, Waterbury 20, Conn.

T16 **INDICATING AND RECORDING THERMOMETER** — Folder contains descriptions and specifications for 5 different types of indicating and recording thermometers as well as for bulbs and fittings. Electric Auto-Lite Co, Instrument & Gauge Div, Toledo 1, Ohio.

T17 **MECHANICAL DIFFERENTIALS** —4-page folder describes Arma mechanical differentials which combine algebraically two mechanical quantities measured by angular displacement. Designed specifically for high accuracy application. Arma Corp, 254 36th St, Brooklyn 32, N. Y.

PIPING, FITTINGS, VALVES AND SPECIALTIES

U23 **AIR RELIEF TRAPS** — Single-sheet bulletin No. 206 tells about ball float traps for venting air from any liquid under pressure. Hookup diagrams, cross-sectional drawings and physical data and list prices are included. Armstrong Machine Works, Three Rivers, Mich.

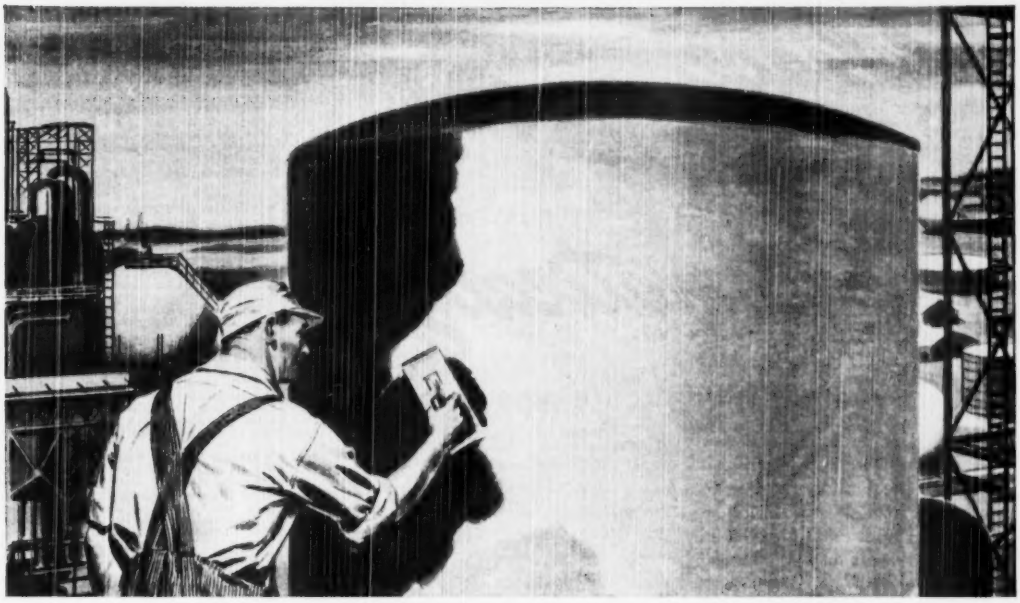
U24 **INTEGRAL BONNET VALVES**—6-page folder No. 105-7-50-B features Powell integral bonnet globe and angle valves, pressure seal "Y" check and angle check valves. A large cross-sectional view explaining the construction features of Class 1500 lb integral bonnet "Y" valve is included. Wm Powell Co, 2525 Spring Grove Ave, Cincinnati 22, Ohio.

U25 **TUBE FITTINGS**—12-page catalog No. 500 covers new improved Flodar Standard (JIC) hydraulic tube fittings of both the flare and no-flare types for industrial use. Complete engineering specifications with recommendations for tubing and wall thicknesses to hold desired working pressures are given. Flodar Corp, 331 Frankfort Ave, Cleveland 13, Ohio.

U26 **VALVES AND FITTINGS** — 48-page booklet No. 52 furnishes details on the company's line of stainless steel valves, fittings and accessories. Also contains engineering drawings, weights, dimensions, size ranges, materials, corrosion data, nomenclature and design data. Cooper Alloy Foundry Co, Hillside 5, N. J.

PUMPS

W9 **CENTRIFUGAL PUMPS**—8-page bulletin No. 636-1 gives complete information on Goulds' new self-priming centrifugal pump line. These pumps are made in sizes ranging from ¼-5 hp

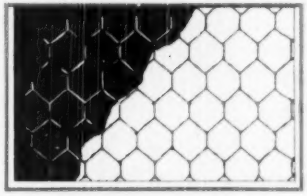


What's wrong with this picture?

This man has buried chicken wire reinforcement under the insulating cement on the outdoor tank shown above. Now he's trowelling a weatherproofing finish over the cement. While this method provides a smooth and attractive surface, the reinforcing does only half its job. It strengthens the cement, but it offers no grip to the weatherproofing finish that is being applied over it.

The wire should be applied after the cement has been troweled on. Then the wire will serve as added support for the cement and will bond Armstrong's Insulmastic finish firmly to the surface.

In most heat insulation jobs, a smooth, neat finish is a good indication of expert, efficient application. This is one exception. When an Insulmastic finish is applied to large areas, a slightly "waffled" appearance of the completed job indicates a strong bond and promises longer service.



NOT SO SMOOTH, but much stronger, the right application of chicken wire reinforces both the asbestos cement and plastic weatherproofing finish.

For the money you spend on a heat insulation contract, you have a right to expect close attention to every detail of the job. All the men in the Armstrong organization—engineers, superintendents, foremen, and workmen—take pride in handling each detail in the right way. They know how important this is to the performance of the insulation and to our reputation for good workmanship. The next time you buy a heat insulation contract, find out how this extra care gives you more for your money. Call the engineer in the Armstrong office nearest you or write direct to Armstrong Cork Company, 7010 Maple Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

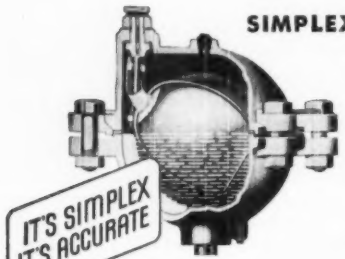
FOR ALL TEMPERATURES FROM 300° F. BELOW ZERO TO 2000° F.

Release ACCUMULATED AIR automatically

—before it can cause pipe damage!

One of the problems most annoying to engineers is the accumulation of air in lines under pressure. When air lodges at high spots in a line, it can reduce the effective area of the pipe, create a friction head, lower pumping capacity, and result in serious water hammer.

Simplex Air Release Valves provide you with a sure and efficient guard against these dangers. These economical valves may be used to advantage on pipe lines carrying hot or cold water, industrial liquors, sewage and other liquids. Find out about these convenient trouble-savers now!



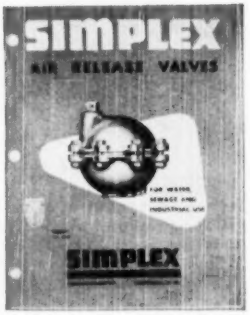
SIMPLEX AIR RELEASE VALVE

The Simplex Air Release Valve is easily installed . . . positive in action . . . ample in capacity. Standard valves for pressures up to 250 p.s.i. . . . special valves for pressures up to 800 p.s.i. Thousands have been in successful use for over 30 years.

Write today for Free Bulletin ➡

PARTIAL CONTENTS

- Essential Requirements for Air Release Valves
- How Simplex Takes Care of Air in Pipes
- Methods of Installation
- Design and Construction Details



Write to Simplex Valve & Meter Co., Dept. 10,6780 Upland St., Phila. 42, Pa.

SIMPLEX

VALVE AND METER COMPANY

with both open and closed impellers. Capacities to 120 gpm and heads to 135 ft depending upon capacity. Goulds Pumps Inc, Seneca Falls, N. Y.

W10 IMPELLER PUMPS — 16-page booklet No. W-317-B16 describes Worthington Mixflo pumps with 2-vane closed impellers. These pumps in types MC, MCC, MCF, MCV, MCZ, sizes 10, 12 and 16, 60-cycle, are used for irrigation, drainage, sewage disposal, condenser circulating, and low-speed water supply. Worthington Pump & Machy Corp, Harrison, N. J.

W11 STEAM JET SYPHONS—24-page catalog No. 2-A covers the complete line of SK steam jet syphons which operate on the jet principle utilizing the energy of steam under pressure to pump, heat, mix liquids and handle solids. Sizes, dimensions, prices and capacities of each type are included in tabular form. Schutte & Koerting Co, Dept JC, 12th & Thompson Sts, Philadelphia 22, Pa.

W12 PORTABLE CENTRIFUGAL PUMPS—Single-sheet form No. 50 features Rice portable self-priming centrifugal pumps in 2 and 3 in. sizes. Sectional view, specifications and dimensions are also given. Rice Pump & Machine Co, Milwaukee 15, Wis.

W13 DEEP WELL TURBINE PUMPS —20-page booklet No. 4700 shows construction details, various types of drive and typical installations of Deming deep well turbine pumps. Pumps are furnished for wells with inside diameter of 4 in. or larger. Capacities vary from 12-3000 gpm. Deming Co, Salem, Ohio.

WATER TREATMENT

X9 HARDNESS TESTS—4-page folder No. 1RE50 explains the extremely rapid, simple and accurate new "one-minute tests" for determining water hardness. Procedures, reagents and equipment for the tests are pictured and described. Hall Laboratories Inc, Hagan Bldg, Pittsburgh 30, Pa.

X10 SCALE CONTROL — 4-page bulletin No. 106 discusses Aqua electric scale control unit which controls the formation of scale in equipment which uses water or is cooled by water. Dimensions and maximum capacities are given. Aqua Electric Scale Control Inc, 2028 E 22nd St, Cleveland 15, Ohio.

OTHER EQUIPMENT

Z16 FANS—2 publications are offered: 80-page book No. DS-348F shows forward curved fans for heating, ventilating, air conditioning and industrial process. Complete with construction features, characteristics, selection data, performance tables, etc. Bulletin No. DS-348U covers the utility fans—trim, compact "package" ventilating units. Trane Co, La Crosse, Wis.

Z17 AIR COMPRESSORS—8-page bulletin No. 1048 describes the firm's "T" Series of stationary air compressors which consists of 2 lines: one designed for normal industrial pressures of 100-125 lbs; the other rated at 200 lbs for continuous service, and up to 250 lbs on intermittent pump-up service. Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.

Z18 VIBRATION ISOLATORS — 12-page catalog No. 504 consists of shock and vibration mounts for protection of industrial, marine, and mobile equipment, ranging from heavy machinery to sensitive instruments. Barry Corp, 199-2 Sidney St, Cambridge 39, Mass.

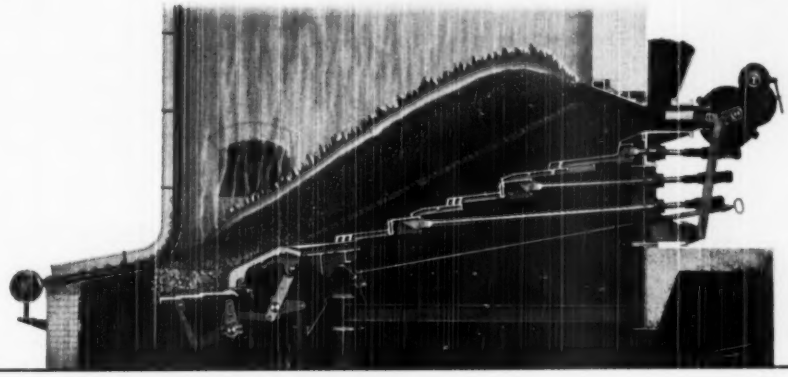
Z19 IMPURITIES REMOVAL—8-page bulletin No. 176 discusses protection of air-powered tools, gages, and process equipment against air-borne impurities. Adams aftercoolers, cyclone separators and Poro-stone air filters are fully described. R P Adams Co, 225 E Park Drive, Buffalo 17, N. Y.

Z20 AIR-HARDENING ALLOYS — Handbook No. 9B is a reference on methods of working seamless tubes and pipe of the intermediate B&W Croloys, ferritic air-hardening alloys containing ½ to 9% chromium. Contains photographs, diagrams and refer-

When you plan a power plant, remember . . .

TAYLOR STOKERS ELIMINATE STACK NUISANCE

AMERICAN ENGINEERING COMPANY



Over 90% of ash delivered to ashpit . . . balance can be handled without costly recovery equipment

YOU'LL MEET the most stringent municipal ordinances on stack discharge with Taylor Stokers – even at low ratings – when installed in properly designed furnaces having adequate grate area. And what's more, the smokeless operation of these stokers is clear evidence of efficient combustion. Elimination of fly ash collectors reduces draft losses and often makes induced draft fans unnecessary.

Taylor Stokers have a precision-control coal feeding mechanism and a unique continuous ash discharge which enable them to burn coals from Nebraska to the Atlantic, and Canadian, British and Continental coals as well. Importantly, too, they give you quick load response and operate with reserve in the fuel bed that will continue steam generation for considerable time in case of interruption to power or coal supply.

Taylor Stokers are designed for generating from 20,000 to 500,000 pounds of steam per hour. Ask your Consulting Engineer. And mail coupon right now for fact-filled booklet on the Taylor Stokers.

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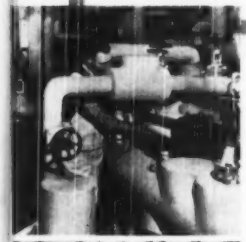

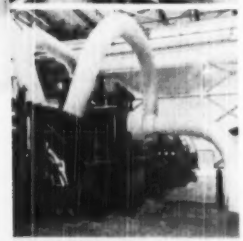

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* Strategically located throughout the United States to best serve industry.
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* Competent insulation engineers, skilled mechanics—plus the advantages of factory co-ordinated experience.
* Reliable duplication of any job in any locality—including materials, workmanship, application methods.

MAY WE REFER YOU TO THE PABCO ENGINEERING SERVICE UNIT NEAREST TO YOUR JOB

THE PARAFFINE COMPANIES, INC.

PABCO

475 Brannan Street, San Francisco 19 — 295 Fifth Avenue, New York 16

Manufacturers of Heat Insulation Since 1920

ence tables. Babcock & Wilcox Tube Co, Beaver Falls, Pa.

Z21 DIESEL ENGINES — 8-page brochure No. 12935 describes diesel engines that operate on the same crude oil that they pump. Contents also cover engines that operate on natural gas and diesel engines powering portable rigs for use in the oil industry. Caterpillar Tractor Co, Peoria 8, Ill.

Z22 MOTOR-DRIVEN WELDER — 4-page folder No. 1202 features the Lincoln Shield-Arc SAE motor-driven welder for all types of welding work from thin metal to heavy plates and structures. Specifications and dimensions are given for both ac and dc models. Lincoln Electric Co, 12818 Colt Rd, Cleveland 1, Ohio.

Z23 DRILL PRESSES — 4-page bulletin No. 402 covers the company's new economy model bench and floor type, 14 in. drill presses. Complete specifications, prices and a list of dealers are given. Attachments and accessories are also illustrated. South Bend Lathe Works, South Bend 22, Ind.

Z24 ENGINEERING SERVICES — 6-page publication, entitled "All Under One Roof" explains the scope of services available from this firm and touches on such subjects as research, process development, product development, production methods, investigations, laboratory testing and analysis, etc. Sam Tour & Co, 44 Trinity Place, New York 6, N. Y.

APPOINTMENTS

Charles G Vogel has been named superintendent of the electrical depts of **Allis-Chalmers** Norwood Works.

Bridgeport Brass Co announces appointment of E D Casseday as its Houston district sales manager to succeed George Chatneuff. Casseday will cover the territory in Southeastern Texas.

A sales office at 79 Milk St, Boston, Mass., has been opened by **Dravo Corp** with R M Barnes in charge. Territory will include Worcester County and state of Rhode Island.

Eagle-Picher Sales Co names Glen J Christner general manager of its insulation operations. He will be located at the firm's general offices in Cincinnati.

I Russell Berkness Co, Richmond, Va., is now sales and service representative in the state of Virginia for **Edward Valves Inc.**

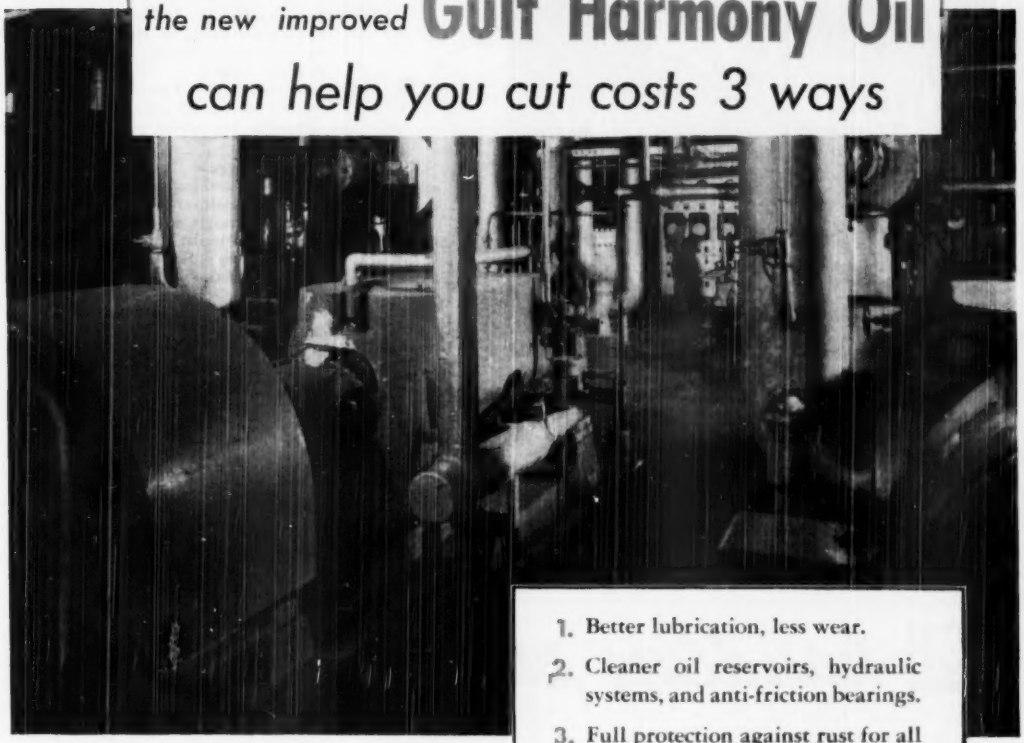
Electric Storage Battery Co has announced the retirement of W B Bowie, manager of engineering sales at the firm's Philadelphia plant.

Pell W Foster Jr has been named vice-president in charge of a newly created equipment div of **Foster Wheeler Corp.** New York. He will continue as active head of production and procurement depts.

Flexitallic Gasket Co announces some new agents and one distributor in its field organization, thus: Metrol Co, Detroit, Mich., is agent for entire lower peninsula of Michigan, including the Toledo area in Ohio; Power Specialty Co, Houston, Texas, distributor, will serve eastern Texas and western Louisiana; Illes Power Control Co, Cleveland, Ohio, is agent for northern Ohio, east of Toledo area; and Airdraulic

For pumps, compressors, and other oil-lubricated auxiliary equipment

the new improved Gulf Harmony Oil *can help you cut costs 3 ways*



1. Better lubrication, less wear.
2. Cleaner oil reservoirs, hydraulic systems, and anti-friction bearings.
3. Full protection against rust for all oil-bathed surfaces.

The new improved Gulf Harmony Oil provides the kind of protection that means lower maintenance costs and freedom from lubrication troubles. Users report that it is the best lubricant they have ever used for pumps, compressors, blowers, and other oil-lubricated plant equipment. They also report excellent performance in hydraulic applications.

Gulf Harmony Oil is enriched with a remarkable new oxidation stabilizer—another important Gulf Research development. This additive improves the already outstanding oxidation stability of Gulf Harmony Oil—gives it exceptional resistance to sludging. In oil lubricated bearings it far outlasts competitive oils.

Gulf Harmony Oil has been fortified to provide an even more effective rust preventive film. Now you can be sure of full protection against rust for all oil-bathed surfaces. It is particularly effective for ball and roller bearings operating under wet conditions. And it separates readily from water.

This outstanding oil provides more effective protection for bearings, gear units, hydraulic mechanisms and compressor cylinders. Available in a wide range of viscosities.

For more complete information on Gulf Harmony Oil, call in a Gulf Lubrication Engineer today. Write, wire, or phone:

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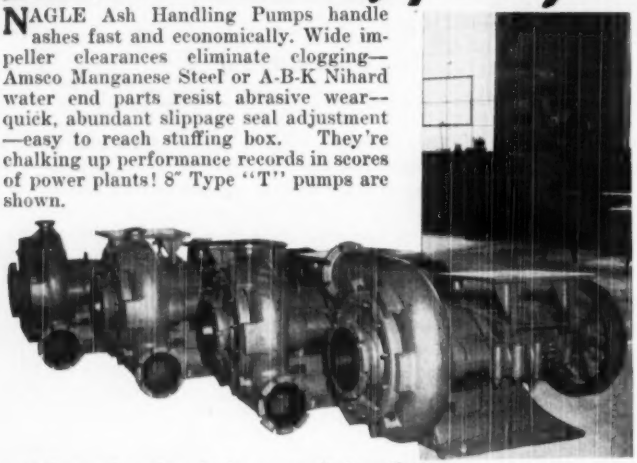
ASH handling pumps

NAGLE Ash Handling Pumps handle ashes fast and economically. Wide impeller clearances eliminate clogging—Amsco Manganese Steel or A-B-K Nihard water end parts resist abrasive wear—quick, abundant slippage seal adjustment—easy to reach stuffing box. They're chalking up performance records in scores of power plants! 8" Type "T" pumps are shown.



- Pumps for other abusive power plant applications.
- Ask for Catalog 4906.
- Qualified Representatives Everywhere.

Nagle Pumps, Inc.
INDUSTRIAL PUMPS FOR ABUSIVE APPLICATION
1251 Center Ave. — Chicago Heights, Ill.

Equip Co, Buffalo, N. Y., is agent for western New York, including the Syracuse area.

A new Los Angeles district office has been established at 3931 Twoedy Blvd, South Gate, Calif., by **Hagan Corp** and its subsidiaries—Calgon Inc; Hall Labs Inc, and Buromin Co. The office will also represent Bull & Roberts, which is associated with Hagan and subsidiaries in the marine engineering field.

General Electric Co reports the following personnel changes: Edward A Green is now staff assistant to A W Bartling, general sales manager of small apparatus divs with headquarters at Lynn, Mass. Green will be replaced by L Dean Fowler as manager of sales of control divs, Schenectady, N. Y. John B Powell succeeds George H Jump as manager of Apparatus Dept's engineering div in New England district located at 140 Federal St, Boston. Jump becomes engineering consultant for the district. Elbridge G Dudley and Louis F Rodewig are named manager and assistant manager, respectively of Apparatus Dept's industrial div in New York district.

In addition, **GE** has appointed J David Wright assistant manager of industry divs at Schenectady, N. Y. He has been replaced by Frederic M Roberts as manager of industrial engineering divs. Leonid A Umansky has assumed duties as manager of engineering of industrial engineering divs.

Robert L Smith and Fred A Dathe have been named sales engineers for **Kaylo Div,** Owens-Illinois Glass Co. Smith will cover the Cincinnati territory, which includes southern Ohio, Indiana, West Virginia, and Kentucky as far west as Owensboro. Dathe will assist J D Hailey, working from Toledo and covering territory of Ohio, Indiana and Michigan.

Manning, Maxwell & Moore Inc, announces election of Hamilton Merrill as president of the firm to succeed Robert Ross Wason, who died July 7.

Ralph E Holmes is now manager of **Republic Flow Meters Co's** Cincinnati district which includes central, western and southern Ohio and eastern Kentucky.

Eric G Peterson has been elected to the board of directors and appointed vice-president of **Peabody Engrg Corp,** New York. In addition to his new duties he will continue as general manager in charge of both the New York office and the Stamford plant of the firm.

Permutit Co, New York, announces that it has acquired from American Cyanamid Co its ion exchange business and the trademark "Ionac." These materials will be manufactured and distributed by Permutit's subsidiary, American Zeolite Corp.

Southern Marine & Supply Co, 10 E Bay St, Savannah, Ga., is chosen as distributor for **Republic Rubber Div,** Lee Rubber & Tire Corp. Wetzel Equip Agency, 375 S

PRIMING OR FOAMING?

Carryover is a tough problem that you can't argue, or guess, out of existence. It can cause serious mechanical, operating and processing difficulties, ranging from damage to process materials to deposits on high pressure turbine blades. To know the cure, you *must* first know the cause. The chief causes of carryover are priming and foaming.

> *Priming*, the *mechanical* entrainment of boiler water in steam, is caused by "belching" or surging. Its correction usually involves *mechanical* considerations, such as operating and design modification.
>
> *Foaming*, the entrainment of boiler water in steam, is caused by build-up of foam. It results from high alkalinity, high dissolved and suspended solids, oil contamination, etc. Correction of foaming usually involves *chemical* considerations, such as proper control, anti-foam treatments, etc.

The Drew System of Water Treatment eliminates guesswork! It starts with proper diagnosis. It includes recommendations for corrective treatment and other preventive measures, such as modification of operating cycles and redesign of equipment, if required. It is specialized service applied to your individual boiler problem.

Don't gamble with guesses! Consult the Drew Engineer or write for further information on carryover and other water problems.

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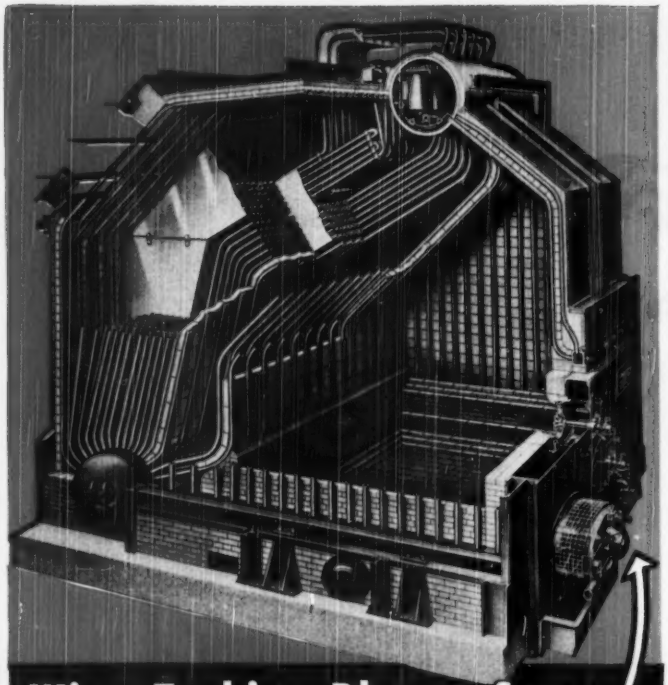
Power Chemicals Division

E. F. DREW & CO., INC.

15 East 26th Street, New York 10, N. Y.

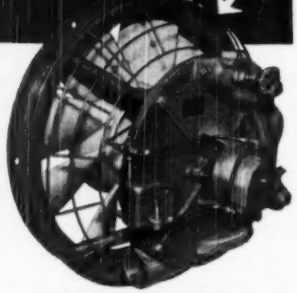
Nationwide service in Boiler Water and Cooling Water Conditioning

DREW PRODUCTS



Wing Turbine Blower Saves Floor Space, too

Besides furnishing forced draft with precise control, the Wing Turbine Blower contributes to the cost-saving features of the B & W Integral Furnace Boiler, illustrated above, by saving valuable floor space, avoiding duct work and large space requirements. It is also quiet and efficient in operation.



A copy of Wing Bulletin No. SW-50 on Wing Blowers and Turbines will be sent on request.

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AXIAL FLOW BLOWERS

West Temple, Salt Lake City, Utah, is also named a distributor for the firm.

Leonard E Bees has been made vice-president in charge of manufacturing of **Trumbull Electric Mfg Co,** Plainville, Conn.

Warren Steam Pump Co, Warren, Mass., announces purchase of **Quimby Pump Div** of H K Porter Co. All manufacturing will be transferred to the Warren plant. A repair and spare parts service will be set up to take care of present and future users of Quimby pumps.

Philip Barnes has been promoted to general sales manager of **Weston Electrical Instrument Corp,** Newark, N. J.

Ampco Metal Inc appoints Alfred D Jenss district manager of its Cincinnati office.

Wren Malone has been assigned to sales staff of the Chicago branch of **Enterprise Engine & Machy Co.** He will cover territory of Illinois, Ohio, Indiana, Michigan and Wisconsin.

Jessop Steel Co, Washington, Pa., announces election of Frank B Rackley as president of the company.

D C Wedlick becomes district sales engineer in the Muncie-Anderson, Ind., area for **Michigan Tool Co.** His office is at 401 Willow Drive, Muncie.

Nickel Cadmium Battery Corp has chosen J F Collins, Statler Bldg, Boston, Mass., as New England sales representative.

Dr Robert J Wiseman is now vice-president and chief engineer of **Okonite Co,** Passaic, N. J.

National Electric Products Co has created within its sales organization a western region and has named R Graham Holabird, regional manager. His office is at 400 Potrero St. San Francisco, Calif.

James D Abeles is now vice-president and general manager of **Purolator Products Inc,** Rahway, N. J.

Superior Electric Co has opened a Cleveland office headed by Harold W Lorenson. The new office, at 1940 E 6th St, will serve the Ohio and western Pennsylvania areas.

Alan J Bronold takes over duties of Allen Adams, as sales manager of **Sterling Electric Motors Inc,** Los Angeles, Calif. Adams is stepping down from active sales management due to illness, but will continue on as an officer and secretary-treasurer of the firm.

U S Rubber Co names John C H Wendes production manager of its Naugatuck Chemical div in Connecticut. Also, Thomas H Fitzgerald becomes sales manager for reclaimed rubber and Joseph P Monahan general control manager of the div.

Arthur B Tesmen joins the staff of **Tempil Corp,** New York, as sales engineer.

(*Continued on page* 202)

AUTOMATIC COMPENSATION

for pressure or temperature
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When actual pressure and temperature differ from the base conditions used in the orifice calculations, a "correction factor" must be applied to the readings of any conventional flow meter.

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United Centrifugal Pumps, div of United Iron Works, has opened a regional office in Houston, Texas. It will be managed by Halley Johnston who will act in an advisory and supervisory capacity over the activities of the Houston, Tulsa, St. Louis and Denver district offices. Also, Eastern headquarters have been established at 225 Broadway, New York City, headed by John Re.

Gould-National Batteries Inc is the new name of National Battery Co, purchasers of Gould Storage Battery Corp. Sales and field engineering headquarters for this group will continue to be located in Trenton, N. J. M W Heinritz, formerly vice-president of Gould, is now vice-president in charge of industrial sales of Gould-National.

Daniel B Altman has been appointed by **Kuljian Corp,** engineers and constructors of Philadelphia, to head its new dept of management engineering.

E E Cobb and Theodore F Collier have joined the staff of **Westcott & Mapes,** consulting engineers of New Haven, Conn.

William E Wall is now associated with **Rader Knappen Tippets Engrg Co,** Miami, Fla., engineers and consultants. He will be in charge of the mechanical dept.

OBITUARIES

Dr Charles M Allen, 78, internationally known consultant in hydraulics, died Aug 15 in Holden, Mass.

James D Mortimer, 71, former president of Union Electric Co, died July 19 in his summer home at Northport Village, Me.

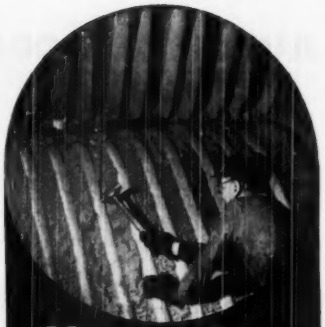
A B Smith, 55, assistant manager of engineering dept, National Electrical Mfrs Assn, New York City, died Aug. 15.

Dexter Boles, 63, asst general supt in charge of power for the New York City Transit System, died suddenly on August 20 in New York City.

Ultrasonics

(*Continued from page* 167)

that ultrasonics will also find use in weld inspection. Equipment is quite portable and reasonably fast. It has certain basic deficiencies, however, among which are :(1) lack of a permanent record (2) great dependence on skill and integrity of the operator, and (3) difficulty in establishing a standard of acceptance that will detect minor but dangerous discontinuities in the root area of welds. Kellogg is now applying ultrasonics to welded joints with known defects (disclosed by routine radiographic inspection) in an effort to establish the reliability of the method and to gain operator experience in interpretation.



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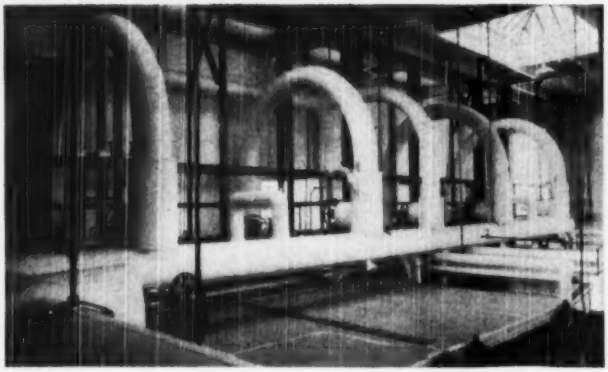

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ST. LOUIS 9 3176 Brannon Ave.
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World Power Conference

(*Continued from page* 134)

with pressure variation according to load has been developed by Messrs Escher Wyss in Zurich along ideas proposed by Ackeret and Keller. The new prime mover, it is felt, will find its field of application side by side with steam and diesel plants.

LAND-TYPE GAS TURBINES, *by D M Smith, gas-turbine dept, Metropolitan-Vickers Electrical Co.* Paper No. 3. At present gas turbines in Great Britain are being offered on commercial terms only for burning liquid or gaseous fuel, which limits their economics application for land power service. The author points out the attention now directed to coal-burning gas turbines and discusses somewhat their prospective application plus those with coal-fired boilers pressurized by gas-turbine plants.

MODES DE PRODUCTION D'ENERGIE COMPORTANT L'EMPLOI PARTIEL DE TURBINES A GAZ, *by Maurice Roy, President de la Commission de las Turbine a Gaz, Paris.* Paper No. 5. Considers two systems, which combine the use of gas turbines with alternative machines: motor-turbine system and the so-called equi-pressure one introduced in France.

AIRCRAFT GAS TURBINES, *by J S Alford, General Electric Co.* Paper No. 7. There are certain significant tendencies in aircraft gas-turbine trends, as the author sees things. These tendencies, as they affect future gas turbine development, are discussed.

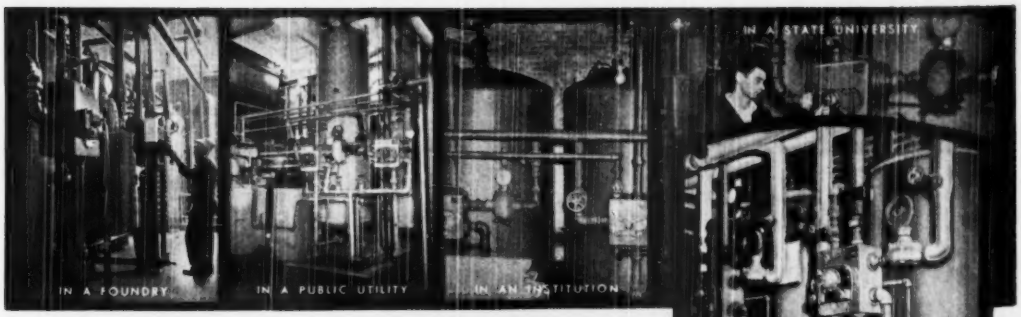
POWER-PLANT REQUIREMENTS FOR FUTURE AIRCRAFT, *by F M Owner, chief engineer, and S G Hooker, assistant chief engineer, engine div, Bristol Aeroplane Co.* Paper No. 6. Art of aircraft propulsion has recently passed from a stagnant to a highly active period. Propeller has a number of rivals. This paper attempts to disentangle interaction of factors affecting main thermodynamic cycle and the propulsive mechanism.

AMERICAN GAS-TURBINE PRACTICE, *by L N Rowley, executive editor, B G A Skrotzki, associate editor,* POWER, *McGraw-Hill Publishing Co.* Paper No. 4. Review of practice in locomotive, stationary and marine fields. Potential return in manufacturing and operating savings has led to intensive development activity in the locomotive field.

Internal Combustion Engines—Section F

MODERN TRENDS IN OIL ENGINE DESIGNS, *by I Wans, Ruston-Hornsby, Ltd, sponsored by British Engineers Assn.* Paper No. 1. Survey limited to 4-stroke oil engines covering from 5 to 300 bhp cylinder and speeds from 1500 to 450 rpm. Automotive, large marine and industrial engines are not covered.

SUMMARY OF CURRENT DEVELOPMENTS IN LARGE DIESEL AND GAS ENGINES, *by R L Boyer, vice-president and chief engineer,*



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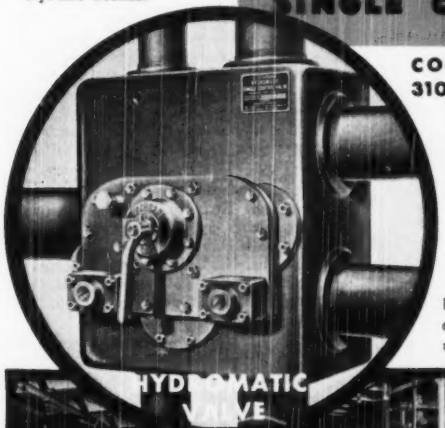

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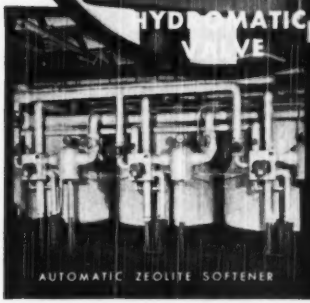
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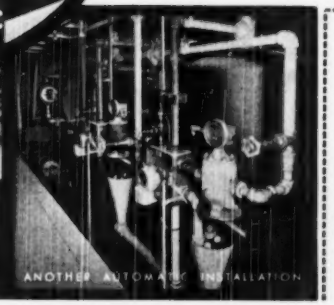
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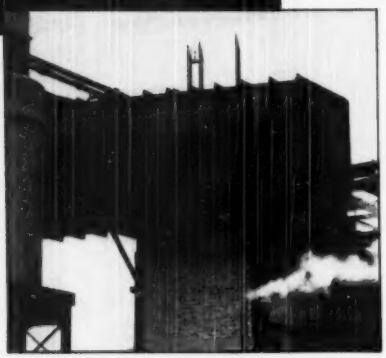

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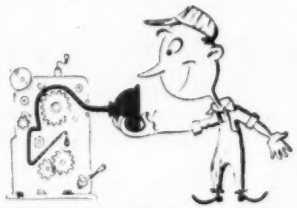

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Cooper-Bessemer Corp. Paper No. 2. Engines from 8- to 32-in. bore with speeds of 1200 to 84 rpm used in stationary locomotive and marine fields including the dual-fuel type are discussed. In stationary practice about 12,000,000 hp are produced by diesel engines and an equal power by gas engines.

SUMMARY OF CURRENT DEVELOPMENTS IN SMALL DIESEL ENGINES, *by M R Bennett, asst chief engineer, Industrial Power Engineering Dept International Harvester Co.* Paper No. 3. Restricted to engines below 8-in. bore. Outputs up to 550 hp are available at 1000 rpm in engines from one to twelve cylinders.

ETUDE COMPARATIVE DU RENDEMENT DES PRINCIPALES CATEGORIES DE MOTEURS A COMBUSTION INTERNE, *by Max Serruys, Comite National Francais.* Paper No. 4. Probable value of the ratios and of the correction factors for different types of engine and fuel estimated and correlated with observed values of over-all thermal efficiency.

DU CHOIX DES CARBURANTS POUR LES MOTEURS A COMBUSTION INTERNE, *by F Picard, Comite National Francais.* Paper No. 5. Engines are not considered in detail but their performances, efficiencies and service characteristics are discussed in relation to over-all economies.

RECENT DEVELOPMENTS IN LIGHT-WEIGHT SPARK-IGNITION AND COMPRESSION-IGNITION PISTON ENGINES, *by A W Robotham, director and chief engineer, Rolls-Royce, Ltd.* Paper No. 6. A 2-part paper dealing almost exclusively with engines for land transport. Spark ignition and compression-ignition form the two parts.

Steam Generation—Section E 2

DEVELOPMENTS IN WATERTUBE BOILER DESIGN, *by W F Simonson, technical officer, Watertube Boilermakers' Assn.* Paper No. 1. Discussion of British design. It emphasizes postwar plant shortage and inferiority and higher cost of fuels. Highest pressure and temperature at present are 1600 psi, 1070 F.

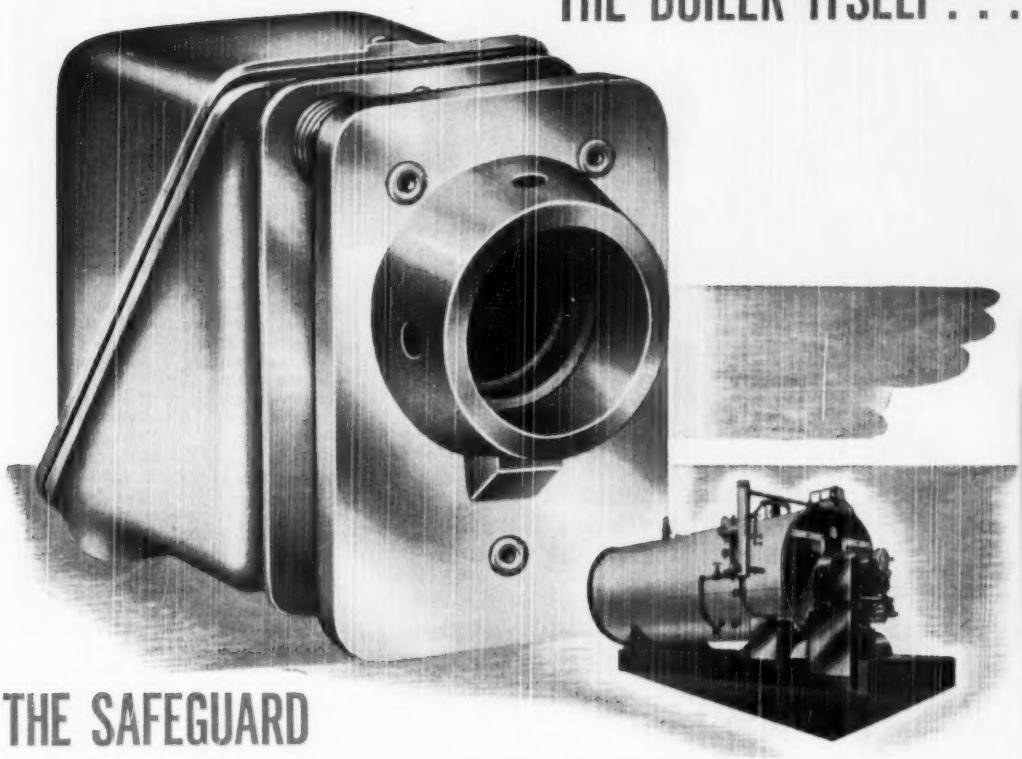
DESIGN OF MODERN STEAM-GENERATING UNITS FOR HIGH-PRESSURE HIGH-TEMPERATURE SERVICE, *by W H Armacost, vice-president, Combustion Engineering-Superheater, Inc.* Paper No. 2. Boilers manufactured by the author's firm and operating at or above 900 psi. Annual availability is about 90% including routine outage.

TRENDS IN AMERICAN BOILER-PERFORMANCE REQUIREMENTS, *by W H Rowand, chief engineer, Babcock & Wilcox Co.* Paper No. 3. Status of boiler design as experienced by this manufacturer indicates that rising construction and labor costs along with higher-cost fuel and changes in fuel quality have spurred progress.

COMBUSTION OF LOW-GRADE FUELS ON STOKERS, *by J Price Walters, acting chief fuel engineer, and H A Haines, regional fuel engineer, Ministry of Fuel and Power.* Paper No. 5. Work Boiler Availability Committee set up at beginning of war has greatly decreased boiler outages and has aided in general attention being paid to effect of poorer fuels on design.

(*Continued on page* 208)

MORE IMPORTANT THAN THE BOILER ITSELF . . .



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La Production de l'Energie Electrique Avec des Anthracites Portugaises a Haute Teneur en Cendres, *by R Sarmento de Beirs, directeur technique de la Hidro-Electrique du Cavado.* Paper No. 4. How anthracite with 3½% volatile and below about ⅛ in. in size was burnt on chain-grate stokers.

Low-Grade Coals of India and their Utilization for Thermal Power Generation, *by C S N Raju, chief engineer, Central Electricity Commission, Government of India.* Paper No. 6. Because of limited resources of high-grade coals needed mostly for railway and metallurgical purposes the anticipated thermal generating expansion in India (from 919 MW in 1948 to 1885 in 1958) must be based on low-grade coals. The government has encouraged this policy and the author suggests it be still further encouraged.

L'Utilisation des Combustibles Fossiles Italiens, *by F Roma, president du Conseil Technique de l'Associazione della Combustione, and D Sandulli, secretaire general du Comitate Italiano Carboni.* Paper No. 7. Italy at present imports 85% of her solid fuel. Some native fuels and methods of burning them.

Oil-Fired Marine Boilers, *by Captain W Gregson, Babcock & Wilcox, Ltd.* Paper No. 8. Marine propulsion in past decade has changed over almost completely to oil. Reviews general design of boilers in marine field and their operating range.

Some Views on Combined Gas- and Steam-Turbine Plants, *by O A Wiberg and C R Nicolin, Svenska Turbinfabriks Aktiebolaget Ljungstrom, Finspong.* Paper No. 9. Proposal to raise upper temperature of thermodynamic cycle by placing a gas turbine before a steam boiler and using the combustion air as fluid in the gas turbine.

Conversion of Locomotives to Burn Fuel Oil Instead of Coal, *by Mohamed Affifi Bey, mechanical dept, Egyptian State Railways.* Paper No. 10. Interesting account of adjustments to oil-burning equipment to improve combustion, increase efficiency, reduce maintenance.

Tendances Actuelles Dans la Technique des Centrales Electriques a Vapeur en Belgique, *by R Beduwe, directeur aux Unions de Centrales Electriques Industrielles de Belgique, and J Bossaert, ingenieur principal a Electroail.* Paper No. 11. In Belgium, as elsewhere, steam generation must use low-quality coals including by-products of grading and washing coals intended for other purposes.

Turbine Practice—Section E 3

Trends and Development in Steam-Turbine Practice for Central-Station Service, *by C B Campbell, mgr of engineering, Westinghouse Elec Corp.* Paper No. 1. Central station steam-turbine development in recent years is characterized by general adoption of elevated steam pressures and temperatures, greater use of the reheating cycle, rapid growth in unit capacity at 3600 rpm, and general improvement of machine dependability.

(*Continued on page* 210)

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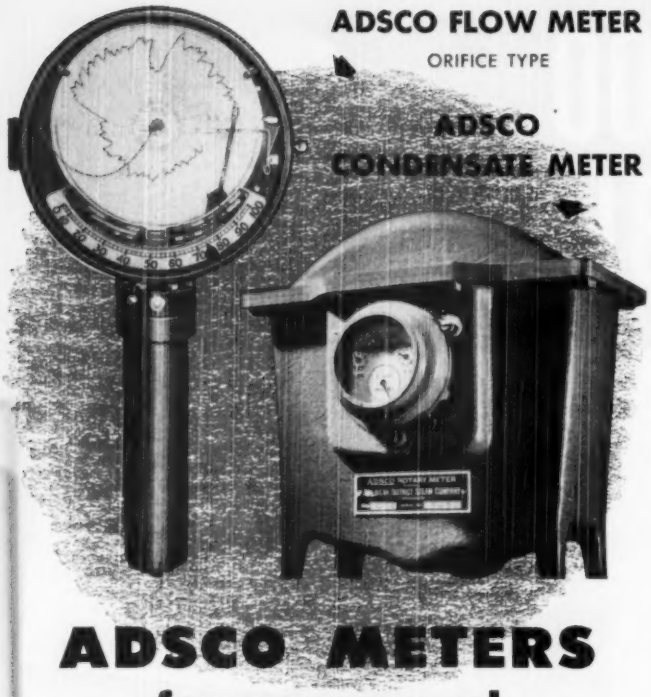

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DESIGN TRENDS IN STEAM TURBINES OF LARGE OUTPUT, *by F Dollin, C A Parson and Co, Ltd,* Paper No. 2. Both impulse and reaction turbines are being built in large numbers. The familiar distinction between the two is modified somewhat by recognition of variation in degree of reaction from inner to outer diameter of a stage in accordance with the vortex theory.

PROGRESS IN DESIGN OF STEAM TURBINES FOR ELECTRIC POWER GENERATION IN U. S., *by Edwin E Parker, mgr of engrg, turbine div, General Electric Co.* Paper No. 3. Rapid expansion of steam-electric generating plants has led to development of large 3600 rpm turbines for operation at initial temperatures as high as 1050 F and of turbines for the resuperheat cycle with steam as high as 2000 psig, 1050 F with reheat to 1000 F.

OPERATING EXPERIENCE WITH HIGH-PRESSURE—HIGH-TEMPERATURE STEAM CENTRAL STATIONS, *by P W Thompson, vice-president in charge of engineering, Detroit Edison Co.* Rapidly increasing loads since start of World War II have made necessary operation at sustained high ratings and high use factors. Starting and stopping of turbines requires close supervision because of high temperature differences involved. Major cause for emergency outage of steam generators is tube failures.

MERCURY CYCLE POWER GENERATION: A PROGRESS REPORT, *by Harold N Hackett, construction engrg div, General Electric Co.* Paper No 5. Summary of operation, present status, design of commercial mercury power plants used in America for production of electrical power and primary steam. This portion covers only last decade of operation.

L'ENTRAINMENT DES AUXILIAIRES DANS LES GRANDES CENTRALES A VAPEUR A HAUTE PRESSION, *by F Flatt, vice directeur, Escher Wyss A C. Zurich.* Paper No. 6. How the partload efficiency of high-pressure thermal plants of large output can be considerably improved by use of auxiliaries that can be driven at different speeds. Particularly where feed pump and also boiler fans are arranged for steam turbine drive.

CONDENSATION BY MEANS OF AIR FOR STEAM TURBINES EQUIPPED WITH INJECTION CONDENSERS, *by Dr Sc Tech L Heller, technical chief, National Enterprise for Power Economy, Hungarian National Committee.* Paper No. 1. Heat exchange devices possessing a high degree of efficiency, recently developed for other purposes, make it possible where water is not plentiful to effect condensation by air only. In the only set of equipment of this kind so far installed, steam leaving turbine was passed into a condenser erected outdoors, where heat of evaporation was abstracted by direct air cooling.

QUELQUES QUESTIONS RELATIVES A LA PRODUCTION D'ENERGIE THERMIQUE, *by C Seippel, directeur, Brown Boveri, S. A., Baden.* Paper No. 1. Several components of a thermal machine may be chosen with various dimensions, sections, surfaces depending on the thermal efficiency aimed at. They must be coordinated to reach the desired effect economically.

PERFORMANCE OF THE COOLING TOWER, *by J C Theron Mulder, engineer of the Aerodynamical Dept of the State Mines, Netherlands National Committee.* Paper No. 8.

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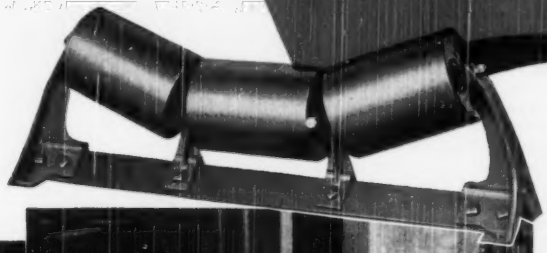

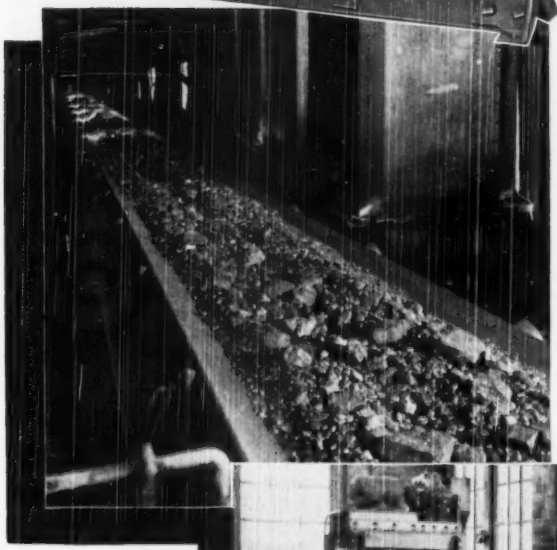

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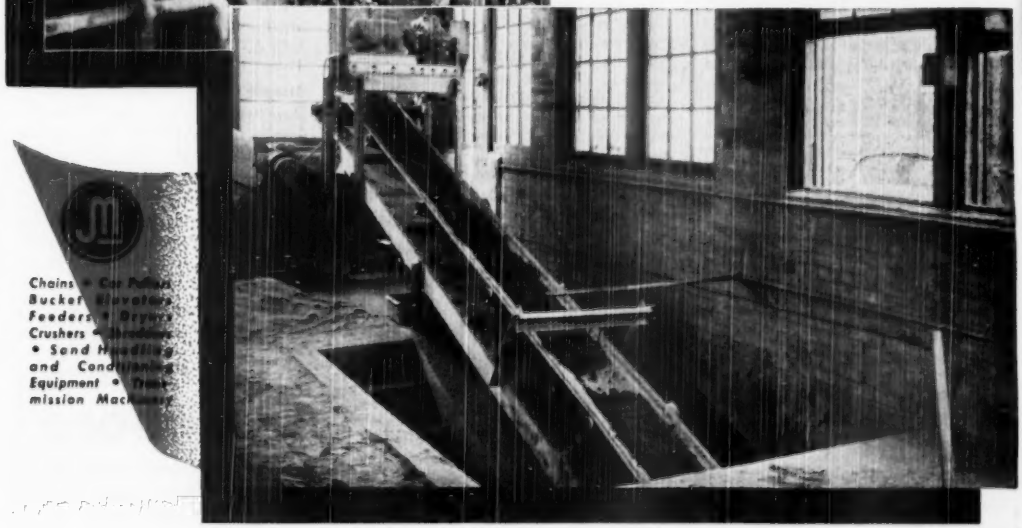

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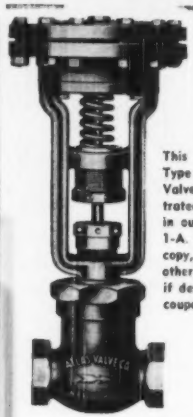

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Numerous factors affecting performance of cooling towers are surveyed, after which the heat balance and its consequences for the water load are discussed.

Fuels and Firing—Section E 4

USE OF WOOD AS FUEL FOR INDUSTRIAL PURPOSES AND RAILWAY ENGINES IN FINLAND, *by Bo Nikander, power engineer, Parzas Cement Wks, and Vaimo Tamminen, asst mgr, Finnish State Railways.* Paper No. 1. Because of the abundance of wood refuse and timber, these materials for steam generation have been of prime importance. Described are the special furnaces and several important design considerations.

ERFAHRUNGEN UEBER DIE VERWENDUNG VAN BRAUNKOHLE UND LIGNIT IN EISENBAHN-LOKOMOTIVEN, *by der Graz—Koeflacher Eisenbahn and Bergbau — Gesellschaft.* Paper No. 2. Experience described shows that with a mixture of one-third hard coal and two-thirds lignite operation can be maintained if railway traffic and terrain are not too difficult.

VERWENDUNG VON BRAUNKOHLE LIGNIT FUR DAMPFLOKOMOTIVEN, *by der Generaldirektion der Oesterreichischen Bundsebahnen.* Paper No. 3. Describes in very great detail merits and demerits of burning brown coal and lignite, also burning a mixture of coal, brown coal and lignite.

UTILIZATION OF BROWN COAL AND PEAT IN DENMARK, *by A K Bak, chief engineer, Copenhagen Lighting Dept.* Paper No. 4. Because of oil scarcity during World War II, gas producers were introduced for diesel-engine service. Recommendations are given on suitability of certain diesels and various gas producers. Costs are also indicated for changeover from gas to oil.

PRODUCTION OF STEAM FROM THE BURNING OF TOWN REFUSE IN DENMARK, *by H H Dahlerup-Petersen, managing engineer, Frederiksberg Refuse Incineration Plant.* Paper No. 5. Primary object of three incineration plants described is to dispose of refuse in a suitable way by incineration without taking up valuable land with refuse tips. Heat produced is used to generate steam and thereby reduce cost of refuse disposal.

PROBLEM OF EFFICIENT BURNING AND UTILIZATION OF VEGETABLE WASTES AND SIMILAR FUELS, *by H E Clausen, chief of technical dept, Tecosa, S. A., Buenos Aires.* Paper No. 6. An experience report on burning of fuels peculiar to Argentina. Describes fuel-burning equipment and furnace designs employed.

NEUE WEGE ZUR ABWARMEVERWERTUNG IN EISEN-UND STAHLWERKEN, *by Prof de techn H Melan, Technischen Hochschule, Wien.* Paper No. 7. Paper describes a standard steelworks consisting of two blast furnaces including the coke-oven plant and a modern steel plant plus rolling mills giving the individual heat and power consumptions. The plant lends itself well to waste-heat recovery because a large amount of blast-furnace gas is available.

(*Continued on page 214*)

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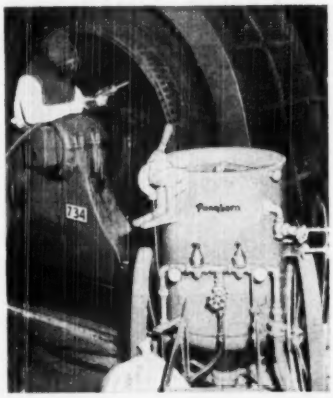

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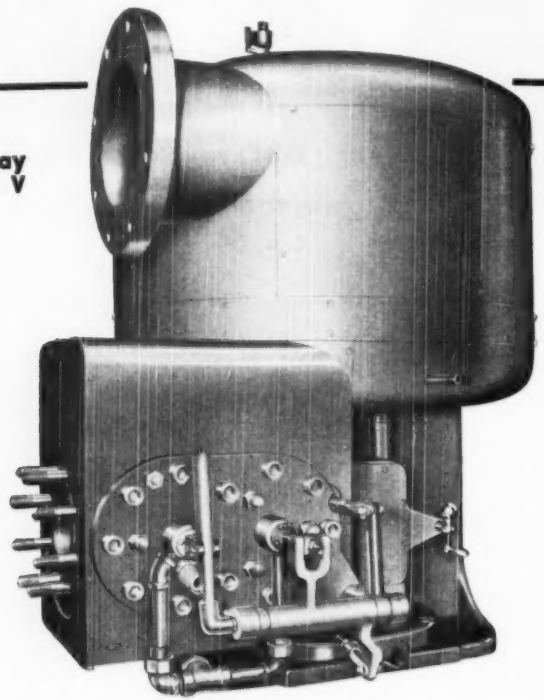

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Power-Station Design—Section E 1

PROBLEMS CONCERNANT LES DERNIERS DEVELOPPEMENTS DES CENTRALES THERMIQUES, *by J. Gastpar, directeur, Sulzer Freres, S. A., Winterthur.* Paper No. 1. Next in importance to developments toward increasing thermal efficiency are those concerned with fuel supply, particularly where they enable an inferior quality coal to be used. Discusses trends in this field.

PRODUCTION OF POWER IN UNION OF SOUTH AFRICA, *by D B Reay, South African National Committee.* Paper No. 2. Mainly because of low cost of coal and circumstances of locality and transport, the generating technique is one of conservatism in both size of units and operating steam conditions. Overhead line practice has been very progressive because of heavy incidence of lightning.

CONCENTRATION DES PUISSANCES DANS LA PRODUCTION D'ENERGIE THERMIQUE, *by J Ricard, chief engineer, Service Central de l'Equipement Thermique, Electricite de France.* Paper No. 3. Cost of energy produced by steam power plants decreases with increasing plant capacity; unit capacities of turbine generators and boilers have greater influence than plant capacities. Investigates optimum capacities of interconnected systems and individual plants.

PROBLEM OF LOCATION OF LARGE STEAM POWER PLANTS, *by Eng W Ney, Polish National Committee.* Paper No. 4. Principal technical and economic considerations to take into account in choosing sites for new steam power plants.

LA PRODUCTION THERMIQUE D'ENERGIE ELECTRIQUE AU PORTUGAL, *by Ilidio Mariz Simoes, ingenieur chef de Services de la Centrale de Tejo des Compagnies Reunies de Gaz et Electricite, Lisbonne.* Paper No. 5. Difficulties of fuel procurement in the recent war caused considerable research on efficient methods of burning indigenous fuels of Portugal. An account of the problems.

POWER STATIONS ON THE NETHERLANDS DURING THE LAST TEN YEARS, *by R Kruk, chief engineer, Provincial Electriciteitsbedrijf Nord-Holland.* Paper No. 6. An accounting of how the Netherlands power plants met an electric demand of almost twice that in 1939 with essentially the same connected generating capacity.

METHOD TO DETERMINE MOST ECONOMIC RELATION BETWEEN BOILER AND TURBINE CAPACITIES OF POWER PLANTS, *by Emil Sovary, chief engineer, State Power-Plant Projecting Bureau, Hungarian National Committee.* Paper No. 7. Calculations in the paper show it is economical to extend capacity of any component, say a boiler, having a restrictive effect, during some time of the year, t, if this time is greater than the product of two factors: (1) ratio of capital cost to total fixed charges (2) ratio of first cost of restricting equipment to total capital cost of whole power plant.

MODERN TRENDS IN DESIGN AND LOCATION OF ELECTRICAL GENERATING STATIONS, *by V A Pask, chief engineer, British Electricity Authority.* Paper No. 8. How the design and location of coal-fired steam plants in Great Britain are planned to fit in with the nation grid system.

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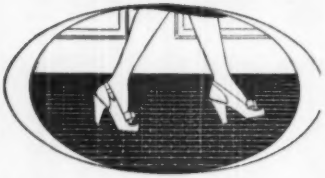

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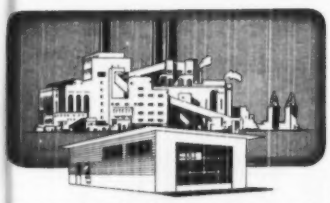

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POWER NEWS

(*Continued from page 136*)

design changes or equipment experiments, thereby seriously impairing future development and progress. (3) Inclusion of many discriminating restrictive clauses was not based on sound engineering but on suppositions, and was sold to civic groups by playing on emotions. (4) Industry as represented by the process people would and could spend much more money and talent isolating and correcting its own problems than any enforcement agency could possibly muster provided the enforcement program was a sensible one.

The discussion met with considerable enthusiasm from the floor. Many questions were directed to the panel. A number of air-pollution problems in various cities across the country were cited as examples of both good and bad enforcement programs.

The meeting closed with the suggestion that the material uncovered in the discussion be referred to the NAPE local membership as an aid in setting up local chapter participation.

Oklahoma A&M Sponsors Diesel Session

Oklahoma A&M College will hold a 3-day conference for diesel-plant operators Oct 23, 24, 25. Engineering Extension Div, in cooperation with School of Mechanical Engineering, is sponsoring the conference.

Men from the diesel-engine manufacturing industries will give most of the talks. Solution of practical problems will be emphasized in each talk, followed by questions and answers. Registration fee is $10. Forward applications to M L Powers, Professor of Engineering Extension Div, Oklahoma A&M, Stillwater, Okla.

Alaska to Have Its First Large Hydroelectric Plant

Alaska is assured of its first large hydroelectric development with legislation authorizing a $20,365,400 power plant at Lake Eklutna, near Anchorage. Under Interior Department plans, water entering the lake—a natural reservoir more than 800 ft above sea level—will be diverted through a 4½-mile tunnel that connects to a concrete surge tank, 96 ft high, near the tunnel outlet. A steel penstock, 7½ ft in diameter and 1250 long, runs down the mountain side to the 30,000-kw power plant, which will produce a firm output of 100,000,000 kwhr per year and about 40,000,000 kwhr of secondary power.

Since it is estimated that power capacity of the Eklutna project would not be fully utilized until the second year following its completion, most Alaska

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A. E. Knowlton, Editor-in-Chief. Eighth edition. 2280 pages, 1961 illus., $12.00

7. NATIONAL ELECTRICAL CODE HANDBOOK
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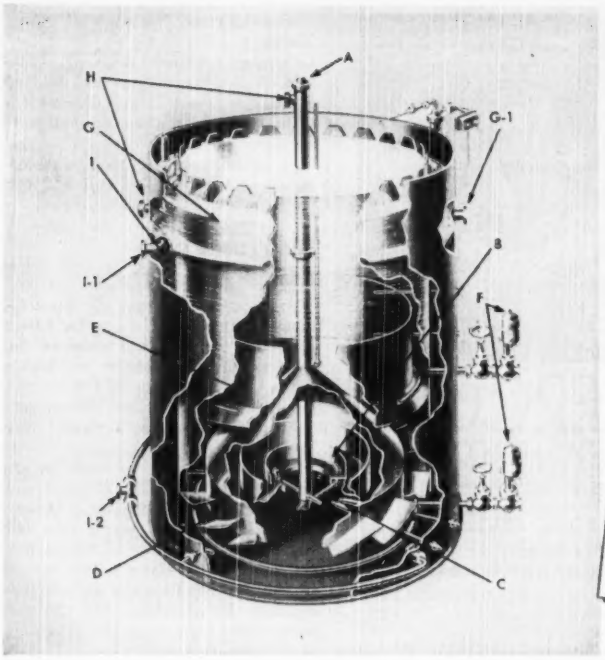

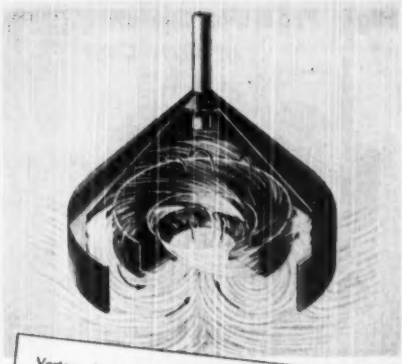

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WORTHINGTON SLURRY TYPE PRECIPITATING WATER SOFTENER AND COAGULATOR gives consistent, uniformly softened water

If it's clear, uniformly softened water you want, this unique Worthington Water Softener is just what you need. Concentrated quick mixing and rapid recirculation of applied chemicals and raw water, *achieved by hydraulic energy instead of submerged mechanical moving parts*, is an important, progressive development in the water treatment field.

New Bulletin W-212-B5 gives you 16 pages of vital facts about this unique cold process water softening method. Write for your free copy today.

REMEMBER . . .

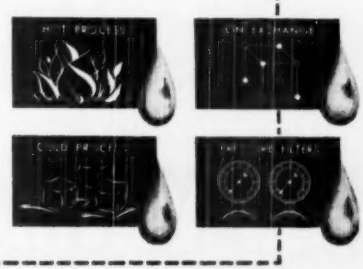
Worthington engineers *all four* water conditioning processes; therefore, can give you unbiased recommendations on which process is right for you . . . further proof that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N. J.*

30.1

WORTHINGTON

WATER CONDITIONING

Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



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at Low Cost

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Check the proportions of each Scottie Jr. and you'll see why it will actually produce approximately double the horse power guaranteed by its rating.

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for 6" scale with pipe diameter markings

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

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AUTOMATIC CONTROLS FOR INDUSTRIAL APPLICATIONS REQUIRING POSITIVE CONTROL OF PRESSURE, TEMPERATURE, LIQUID LEVEL ETC.

SIMPLE TO ADJUST FOR THE SPECIFIED OPERATING RANGE

MERCOID CONTROLS ARE EQUIPPED WITH MERCURY SWITCHES, THEREBY INSURING GREATER SAFETY, BETTER PERFORMANCE AND LONGER CONTROL LIFE

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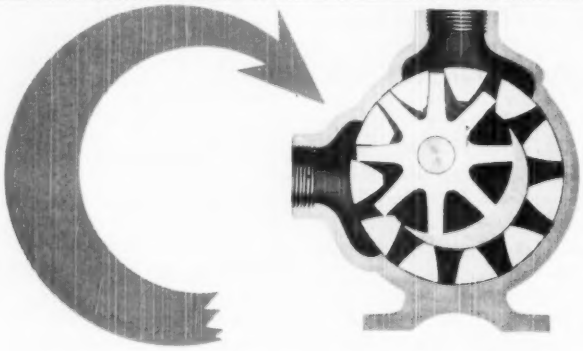

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AN HONORED NAME IN PUMPING

See Our Catalog In SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa

communities are now short of power. Studies now are under way to develop the water resources of the Kenai Peninsula, Matanuska, Susitna and Nenana Rivers. With such further development in mind, the Eklutna project would have a transmission line constructed for ultimate operation at 161,000 v, although initial operation requires only 57,000 v.

Hungry Horse Hydro Schedule Advanced

An accelerated powerhouse construction program on the Hungry Horse Dam project in Montana has advanced the schedule for two generators by about a year's time. So about 142,000 kw will be available by December 1952, to help meet Pacific Northwest's winter peak loads.

First generator will be ready for operation in October 1952, and the second is scheduled to go on the line in December 1952. Third and fourth units will start power production in August and November 1953. Manufactured by the General Electric Co under a $4,397,650 contract, the generators will give the plant a total capacity of 285,000 kw.

Square D Co has started two unusual display and demonstration coaches, the *Detroiter* and the *Milwaukian* on a 37-state tour that will touch Eastern, Midwestern, Southern and Northern states. Each coach has 40 feet of display panels with a wide range of equipment, including safety switches, multi-brakes, industrial circuit breakers, panelboards from the Detroit division and pump controls, timers and relays, contractors, limit switches from the Milwaukee division.

New officers elected at the 53rd annual meeting of the **American Society for Testing Materials** were L J Markwardt, assistant director, U S Forest Products Lab, as president, T S Fuller, General Electric Co, as vice-president, B A Anderton, consultant, research and development, Allied Chemical and Dye Corp, as a member of the board of directors, R H Brown, sales engineer, Parks-Cramer Co, board member, D K Crampton, research director, Chase Brass and Copper, Inc, board member, H G Miller, Chicago, Milwaukee, St. Paul and Pacific Railroad Co, board member, J R Trimble, dept of metallurgy, inspection and research, Tennessee Coal, Iron and Railroad Co, board member.

Westinghouse Electric Corp has announced development of a radically new electrical insulation that makes possible construction of bigger generators. The insulation, called Thermalastic, consists of mica flakes embedded in tough, heat-resistant synthetic resin with sufficient stretch at operating temperatures to expand and contract with generator coils.

WeldELLS®

Let's get down to fundamentals: — There is only one *permanent* way to join pipe — only one joint as strong as the pipe itself — the properly *welded* joint.

A properly welded joint involves just two basic factors — a good fitting and good welding. In the WeldELL line you have not only the fitting that expresses the highest development in engineered strength and closely controlled metallurgy . . . you also have the fitting with features that enables the welder to do his job better and faster.

The WeldELL line embraces the widest range of sizes, weights, types and materials. In many sizes and types there are no fittings BUT WeldELLS!

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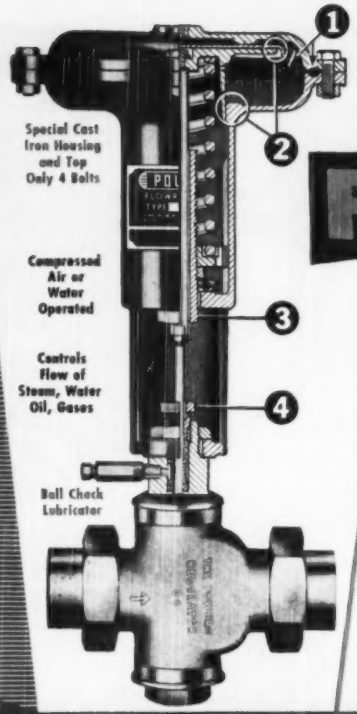

POWERS FLOWRITE VALVE

VALVE TOP—Durable moulded neoprene diaphragm (1) has positive sealing bead which provides increased sealing action with increasing control pressure. Efficient diaphragm form insures ample and constant operating power thru full travel. Piston Plate Assembly (2) has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains stem in accurate alignment.

ADJUSTING SCREW—Ball bearing non-rising type. Easily accessible, 180° turning radius with starting pressure adjustable from 0 to 17 psi. Has enclosed rust proofed steel spring for full travel in 5 or 10 psi. control pressure change.

BONNET ASSEMBLY—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

VARIETY of VALVE BODIES—Sizes ½" thru 8"—For line pressures below 250 psi. Rugged construction to withstand piping strains. Single seat or double seat, bronze and stainless steel trim. Double unions and flanged ends. Available normally open (direct acting) or normally closed (reverse acting) and 3-way type valves.

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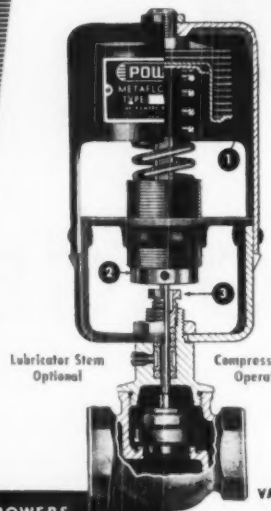
Reduce Maintenance

Packless Valves Available



POWERS METAFLOW VALVE

VALVE SIZES—½" thru 2"

Bronze bodies, screwed ends. Rugged construction to withstand piping strains.

POWERS *Metaflow Valves* are small, sturdy, light-weight, reasonably priced, suitable for many control applications where the pressure differential does not exceed 75 lbs. per square inch.

1. **HOUSING**—High strength aluminum alloy. Hydraulically formed long life brass bellows provides smooth and powerful stroke.

2. **ADJUSTING SCREW**—Brass with rust proofed steel spring having 15 lbs. adjustment range to give proper sequence operation where required.

3. **BONNET ASSEMBLY**—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

TRIM—Composition disc with brass integral seat and self-aligning disc holder. Available normally open (direct acting) or normally closed (reverse acting), and 3-way.

METAFLOW NO-PAK VALVES prevent leakage of inflammable or harmful liquids or gases and provide vacuum protection. Are suitable for use with Freon, oil, gasoline, non-corrosive gases, hot or cold water and low pressure steam.

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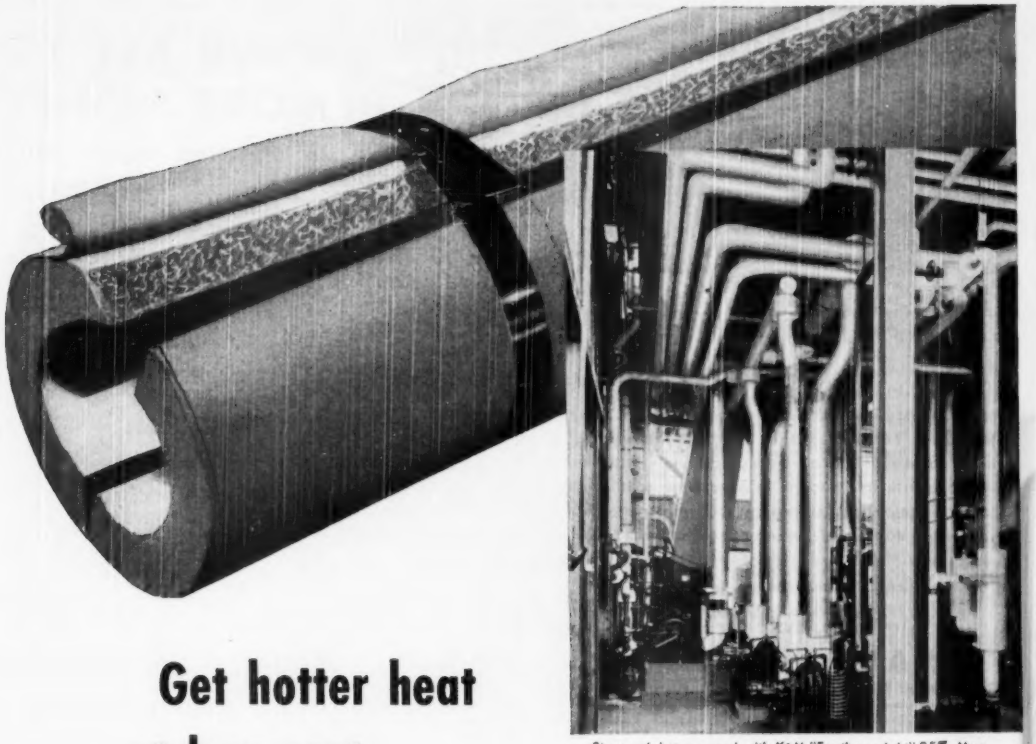

Steam piping, covered with K&M "Featherweight" 85% Magnesia, in Standard and 1½" thicknesses, canvas covered.

Get hotter heat at less cost with K&M "FEATHERWEIGHT"® insulation

Keep heating costs down—and heating efficiency up—with K&M "Featherweight" 85% Magnesia Insulation. 85% Magnesia is the most widely accepted insulating material in its field. And in K&M "Featherweight," basic carbonate of magnesia is combined with selected and specially processed asbestos fibers to produce a highly efficient insulation of extremely low thermal conductivity.

K&M "Featherweight" withstands temperatures up to 600° F. without loss of insulating value. And, though it's amazingly light in weight, it is strong and durable also. It can withstand vibration, a reasonable amount of compression, and its insulating properties are not affected by alternate wetting and drying. As it is entirely mineral by nature, it cannot burn.

"Featherweight" 85% Magnesia insulation is easy—and economical—to apply. It can be stored and handled without any special precautions. No special tools are needed to apply it: "Featherweight" is easily sawed and cut; can be fitted snugly to contours without breaking apart.

K&M "Featherweight" 85% Magnesia is furnished for all standard pipe sizes in sections and in sets of segments 3 feet long in the following thicknesses: Standard, 1½", 2", double standard (broken joint) and 3" (broken joint). Blocks and lagging are also available for irregular surfaces. Ask your K&M Distributor for complete information, or write us direct.

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STORE and RECLAIM this better way!

At a factory burning about 1500 tons of coal a month, silo storage is augmented by open storage of 4,400 tons on a small ground space alongside silo. Stockpile is handled by a 1/3 cu. yd. Sauerman Scraper as shown in the picture. The scraper was installed two years ago to replace a crane and bulldozer. The savings it has effected in these two years has about repaid its original cost.

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makes stockpiling an easy, one-man job

Storage of any desired tonnage of coal is an easy, comfortable one-man job with a Sauerman Power Drag Scraper. This equipment makes full use of any ground space with little advance preparation. It stacks the coal in compact layers, so there are no air pockets to encourage spontaneous combustion. Everything about the equipment is simple and it gives continuous satisfaction with a minimum of attention. Hundreds of operators report that their Sauerman machines are as good as new after many years of service with annual repair costs running as low as one-half cent per ton handled.

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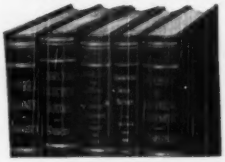

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In addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, specific remedies, etc.

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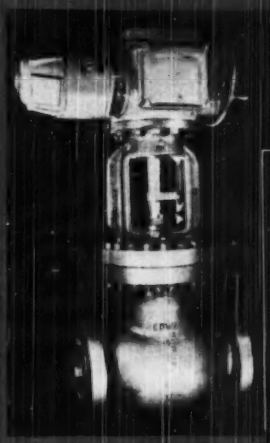
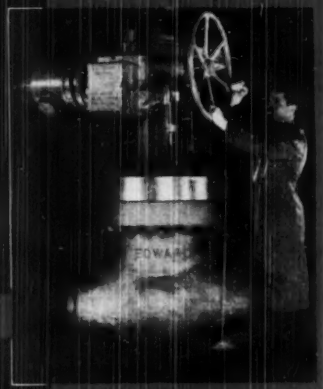
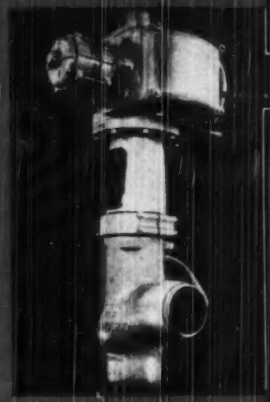
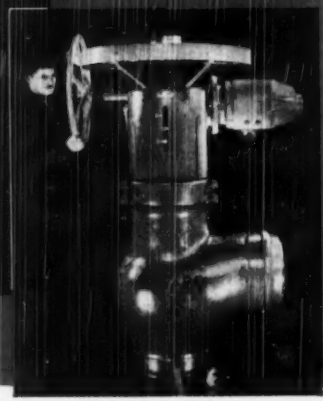
. . . THE MODERN OPERATOR THAT MATCHES THE LATEST TRENDS IN VALVE DESIGN









Photos courtesy Edward Valves, Inc.

Continued advancements in the design and construction of LimiTorque Valve Controls always keeps them abreast with the latest developments in valve manufacture.

LimiTorque opens and closes valves of all makes and types up to 96" diameter by the "push of a button" from either remote or nearby control panels. Damage to stem, seat, disc, gate or plug is prevented because the Torque Seating Switch *limits* the torque, shuts off the motor if an obstruction occurs.

Valves function at maximum desired speeds.

Greater safety is afforded workmen by LimiTorque Remote Control as it is unnecessary to go to high, low or dangerous locations for manual operation.

LimiTorque may be supplied for actuation by any available power source . . . electricity, steam, water, gas, oil or air.

LimiTorque Controls are available through valve manufacturers. Thousands are in daily use on land and sea . . . in Power Plants, Central Stations, Water Works, Refineries, and Oil Pipe Lines.

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Industrial Gears and Speed Reducers
LimiTorque Valve Controls

ILLCO-TEMP SOFTENER AT NATIONAL LOCK

to reduce hardness in hot-process effluent without chemical additions

Power Plant,
NATIONAL LOCK CO.
Rockford, Illinois

For most efficient boiler operation in its new power-plant addition, National Lock solved the problem of after-precipitation and residual hardness in the effluent of its lime-soda softener.

As a result of a pilot-plant test, company engineers recommended the installation of a larger ILLCO-TEMP Softener (10,000 gph) to after-soften the lime-soda effluent without the use of additional chemicals.

The softener (shown at right) operates at 230° F. and has softened over 10 million gallons since its installation.

Exchange capacity of the softener has not declined. Also, through use of zero-soft water in boiler-feed make-up, National Lock has effected a reduction in the cost of chemical additions, as well as increased efficiencies resulting from clean boiler operation.

Write for other case histories and descriptive literature.

Advantages of ILLCO-TEMP

No chemical after-treatment is necessary to reduce hardness . . . with "zero" soft water obtained from the ILLCO-TEMP Hot-Process Unit. Chemical savings from this alone will normally pay for equipment in less than 2 years.

Assures a constant source of "zero" soft water regardless of variations in the raw water or the hot-process effluent.

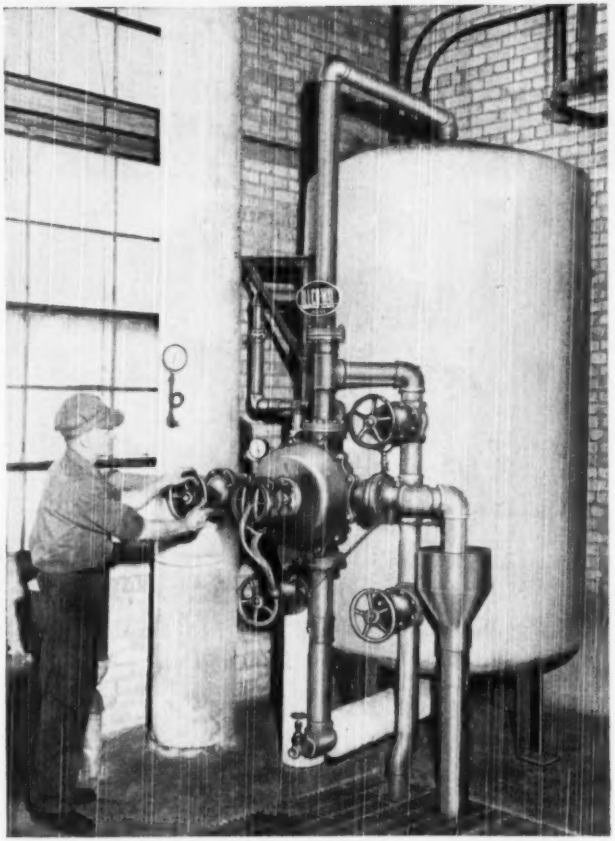
Decreases the excess dosages required for straight hot-process.

Reduces amount of chemicals required in boiler (none needed for hardness control).

Eliminates frequent adjustment.

Eliminates deposits which result in "plugging" in valves, feed pumps, feed lines, heaters, etc.

ILLCO-TEMP unit easily and economically added to your present lime-soda water softener.



ILLCO-TEMP SOFTENER installed in National Lock Company plant operates at 230°F., 10,000 gph.

This is the only method today that withstands high or low pH at high temperatures. The ILLCO-TEMP Softener unit operates economically and continuously at temperatures as high as 250° F. . . . on waters having a pH as high as 10.5. This eliminates the need for a constant control and adjustment of the hot lime-soda dosage, as previously required.

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New York Office: 7310-NN-10 Empire State Bldg., New York City

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DE-ALKALIZING
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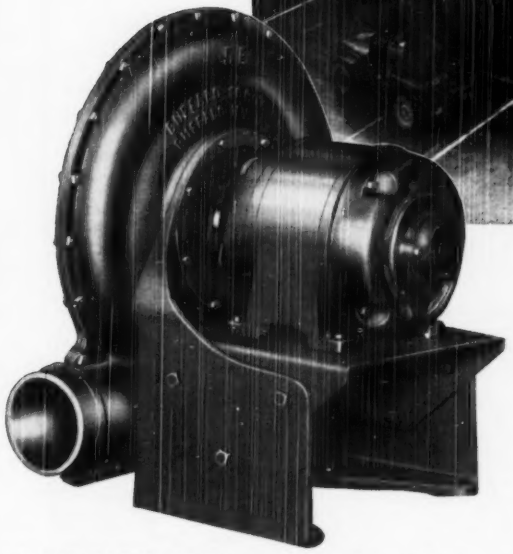
ENGINEERING AND EQUIPMENT—DE-IONIZERS for process water treatment and treatment of liquids and solutions other than water; waste treatment; reclamation of specific constituents. DE-ALKALIZERS: Boiler feed (external); Bottling water. SOFTENERS: Industrial, Domestic. FILTERS, etc.

AIR BY "Buffalo"

HOLDS UP RADAR-SHELTERING "BALLOON"



Two "Buffalo" No. 5-E Blowers, like the above, and a No. 4½-E Blower, are used for inflating each of the 36 giant "radomes" made by Firestone Tire and Rubber Company for protecting Air Force radar equipment. All these fans are lightweight cast aluminum for transporting by air.

- ANOTHER USE FOR "BUFFALO" FANS

A half pound of air pressure holds up this 36-foot-high "radome", even in a 125-mile gale! "Buffalo" Fans are used to inflate this shelter for sensitive radar equipment. Made of rubberized fabric, this "radome" is entered through tunnel and air lock. It has no metal or wood supports of any kind.

When you have a job to be done by air, remember, "Buffalo" Fans have been satisfying discriminating customers for 72 years. Write us about your air need.

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VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

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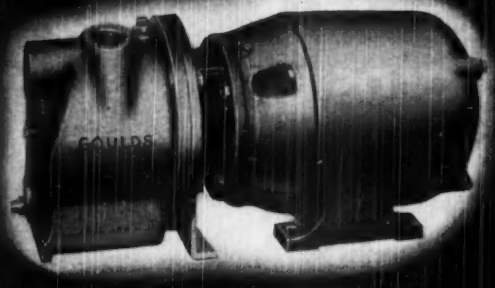

Fig. 3639-3678 Self-Priming Centrifugal

Goulds NEW Self-Priming Pump

Only GOULDS gives you all five of these outstanding advantages

1. Absolutely no valves of any kind in pump—nor are any needed in installation. Liquid can drain out of discharge and suction line through pump without affecting priming ability.
2. No recirculation of liquid after completion of priming action.
3. Efficiencies comparable to quality straight centrifugal pumps are thus obtained.
4. Positive fast-acting self-priming similar to priming ability of positive displacement pumps.
5. No large or bulky priming chambers or reservoirs, providing a compact unit at low cost.

APPLICATIONS:

Any service where suction lifts are encountered. Particularly adaptable for automatic service or where liquids to be pumped contain air or gas. Pump will automatically free itself of air and positively will not vapor lock.

Open impeller type. Sump service • Sewage effluent • Marine-bilge pumping, etc. • Mine gathering and dewatering • Dewatering excavations, cellars, etc.

Enclosed impeller type. Cold and hot water • Low pressure fire service • Pumping from underground supply • Irrigation • Sprinkling • Engine jacket cooling water service • Volatile liquids and light oils • Ice core sucking.

SIZES—CAPACITIES AND OTHER FEATURES

39 Models and Sizes

¼ to 5 H.P. ratings

Open and enclosed impellers

Capacities to 120 G.P.M.

Heads to 135 ft. depending on capacities

Suction lifts to 25 ft.

Also available in Flexible coupling motor drive or belt drive and close-cupld gasoline engine-driven unit.

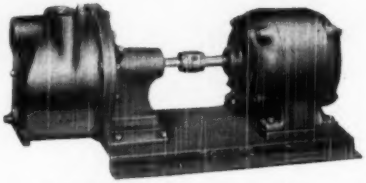

Fig. 3739-3789 Flexible coupling type drive

Patents Pending

FOR FULL DETAILS WRITE FOR BULLETIN 636.1

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Seneca Falls New York

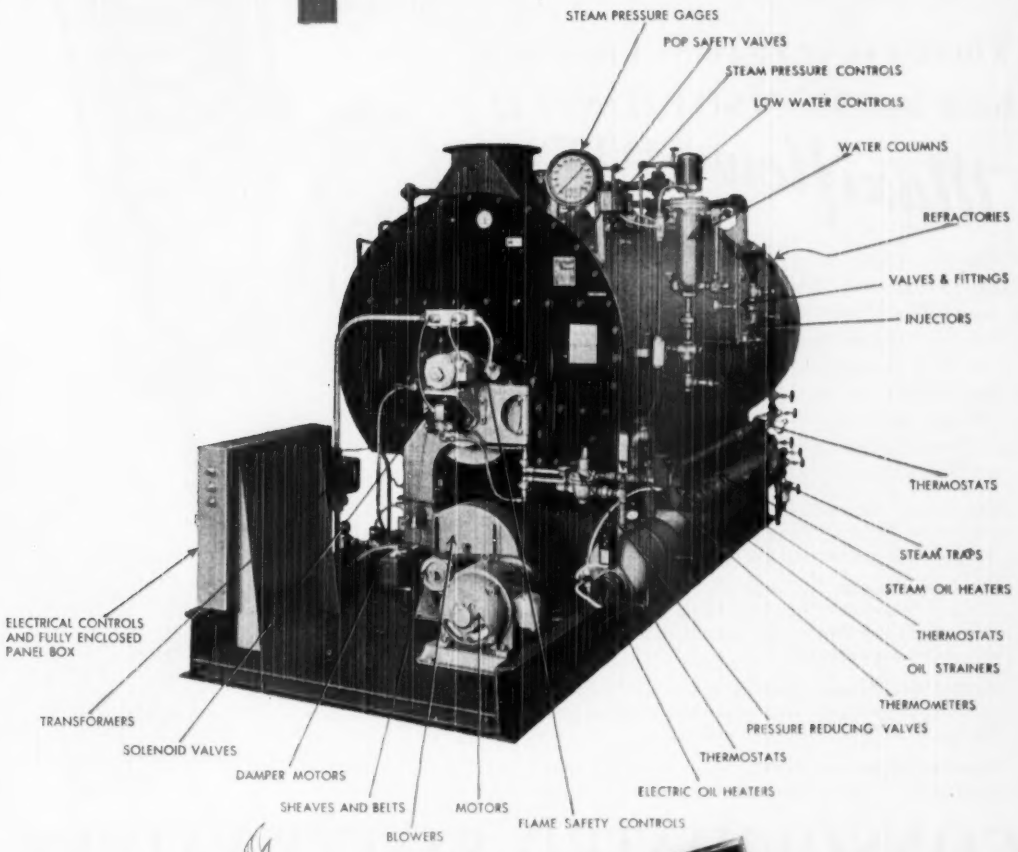
Matched quality components

another reason why you get a greater return from your investment in a Cleaver-Brooks Steam Boiler

Cleaver-Brooks steam boiler quality is the sum of many qualities. From the rolling-in of the first tube and through every step to completion, the highest standard of engineering, material and workmanship prevail. Every component is the tested product of a manufacturer of known standing — carefully selected by Cleaver-Brooks engineers through test and research.

Your Cleaver-Brooks boiler is the end-product of many specialized engineering talents and manufacturing skills. When you install Cleaver-Brooks you have a steam boiler of foremost quality — with immediate and long-range cost-saving advantages. Cleaver-Brooks self-contained Boilers — 15 to 500 HP 15 to 250 lb. p.s.i.— for oil, gas, combination oil and gas firing.

CLEAVER-BROOKS CO., 332 E. Keefe Ave., Milwaukee 12, Wis.

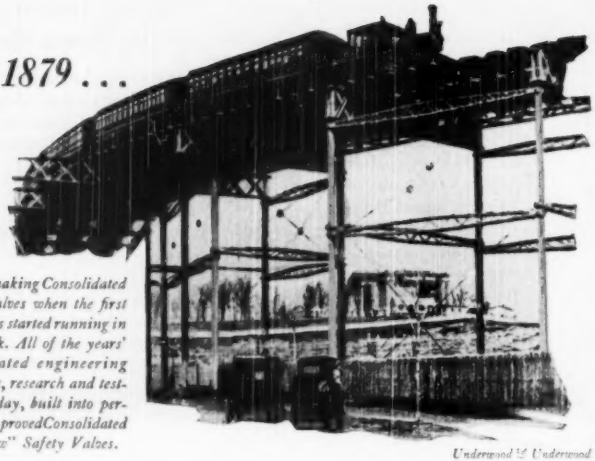


Cleaver-Brooks

STEAM BOILERS

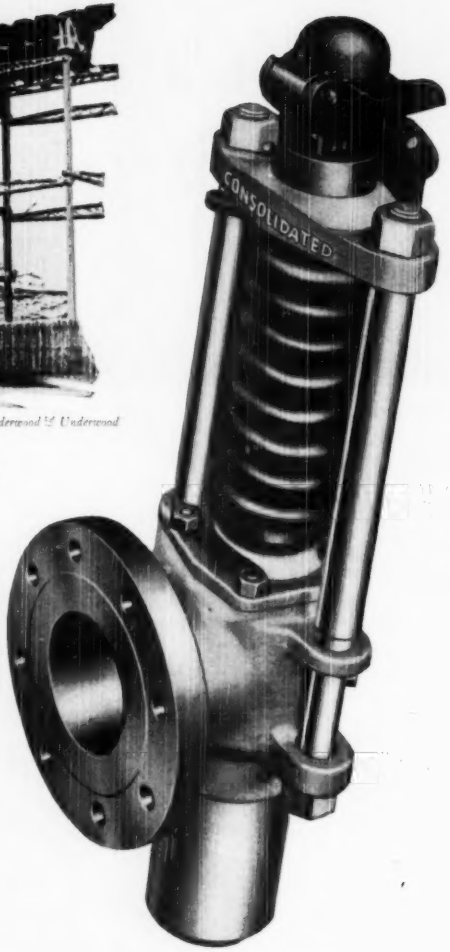
NEW — The Cleaver-Brooks Steam Boiler Catalog — interesting — informative — beautifully illustrated. Write — on your business letterhead for your copy — no obligation.

Since 1879 . . .



We were making Consolidated Safety Valves when the first "L" trains started running in New York. All of the years' accumulated engineering knowledge, research and testing is, today, built into performance-proved Consolidated "Maxiflow" Safety Valves.

Underwood & Underwood



There's over 70 years know-how built into CONSOLIDATED *Maxiflow* SAFETY VALVES

Maxiflow Safety Valves are new *in all that modern engineering can contribute.* But every feature of these valves has been proved by field experience over many years, and by long-time and severe testing methods.

In high pressure, high temperature installations, Maxiflow performance establishes a new standard in safety, efficiency and economy.

These Maxiflow design features mean important operating advantages:

Thermodisc Seat permits rapid equalization of temperature differentials. Thermal stresses are minimized, seat distortion cannot take place, permanent tightness is achieved.

Blowdown Control adjustable to a new, low minimum. The exclusive "micrometer" trim ring provides a simple and practical chatter-proof blowdown control, externally controlled and operable with valve under pressure.

Mechanical Through Bushing with precision machined surfaces that provide constant entrance conditions for steam flow. Eliminates leakage due to porous castings.

Retention of Popping Point is achieved by combining proper compensation with materials having low coefficients of expansion.

For complete description, plus capacity tables, write for the Consolidated Maxiflow Safety Valve Bulletin.

CONSOLIDATED *SAFETY* VALVES

A Product of

MANNING, MAXWELL & MOORE, INC.

BRIDGEPORT 2, CONNECTICUT

Makers of 'Consolidated' Safety and Relief Valves, 'American' Industrial and 'Microsen' Electrical Instruments, 'Hancock' Valves, 'Ashcroft' Gauges. Builders of 'Shaw-Box' Cranes, 'Budgit' and 'Load Lifter' Hoists, and other lifting specialties.

WEIRTON STEEL COMPANY'S Boiler Plant facilities have been twice expanded by Dravo Corporation to keep pace with increasing requirements. Latest (1947) extension adds another complete unit to the high pressure boiler plant and 325,000 lbs. per hr. to steam output. Dravo-built boiler plants serve companies which produce more than 47% of the nation's steel.

DRAVO
CORPORATION

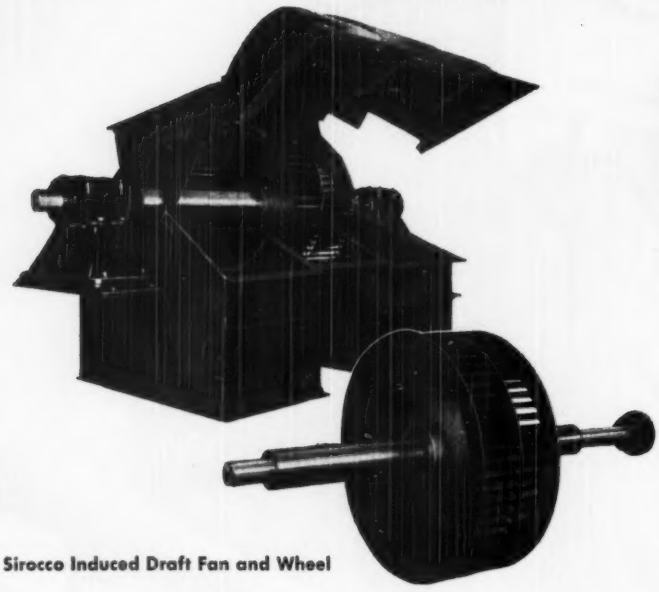
DRAVO BUILDING, PITTSBURGH 22, PA.

Engineering Constructors of power plants, boiler plants, central stations, compressor stations, water pumping stations—fabricators and erectors of power piping—power and boiler plant equipment.

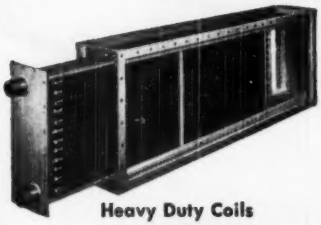
PITTSBURGH · PHILADELPHIA · CLEVELAND · NEW YORK · DETROIT

SIROCCO INDUCED DRAFT FANS

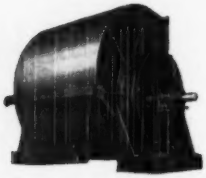
Standard of the World



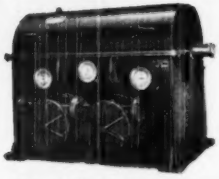
Sirocco Induced Draft Fan and Wheel



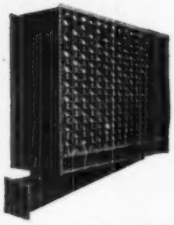
Heavy Duty Coils



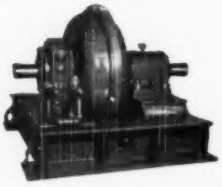
American HS Forced Draft Fans



Gýrol Fluid Drives for Boiler Feed Pumps



Type ST Fly Ash Precipitators



Type VS Gýrol Fluid Drives for Mechanical Draft Fans

The Sirocco Induced Draft Fan (shown above) with die-formed forward curved wheel blades is designed and proportioned specially for induced draft work. **Now used on 1,000,000# /hr. steam boilers.**

The high static efficiency, low RPM, low tip speed, low inlet velocity, plus other important operating characteristics, make this fan particularly well adapted to severe power plant requirements.

For complete, concise, factual data on the Sirocco Induced Draft Fan, write for Bulletin 4424.

For data on other American Blower Mechanical Draft Equipment, Fly Ash Precipitators, Heavy Duty Coils and Gýrol Fluid Drives for fan control and boiler feed pumps—consult your nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

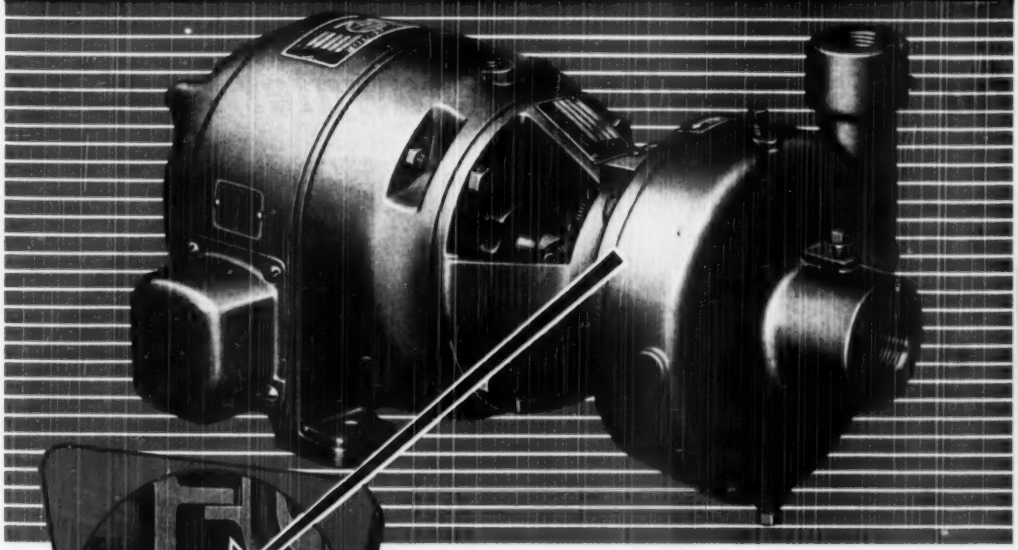
YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT

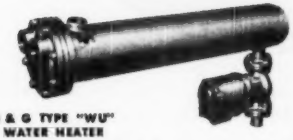
Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

THE 1522 *Challenges Comparison*

. . . WHERE ELSE CAN YOU FIND SO MANY MONEY-SAVING FEATURES IN ONE PUMP!





B & G TYPE "WU" WATER HEATER

Equipped with B & G Booster for pumping boiler water through shell—produces large volume of controlled-temperature hot water from amazingly small unit. Costs less to install and operate.

NO. 1—LEAK-PROOF MECHANICAL SEAL

This feature alone establishes the B & G 1522 Pump as the "buy" for trouble-free operation. A Mechanical Seal, instead of an ordinary stuffing box, assures long, dependable service. The Seal is self-lubricating and eliminates the usual leakage through the packing gland. B & G 1522 Pumps are licking tough pumping jobs the country over.

It's a *quiet* pump! Long bronze sleeve bearings keep the shaft in alignment and spring-type flexible couplings aid in keeping noise at a minimum. The impeller is *hydraulically balanced* . . . highly efficient throughout the capacity range.

You can really *get into* the B & G 1522—if ever necessary. Remove a few bolts and the pump separates into three parts—motor, bearing bracket sub-assembly and pump body. Manufactured to close tolerances, the bearing bracket sub-assembly, including shaft and sleeve bearings, is interchangeable in all B & G 1522 Pumps.

Next time you have a pump to buy, look first at the B & G 1522. It is available as all-iron, bronze-fitted or all-bronze. Send for Catalog CY-350.

B & G

***Hydro-Flo** REFRIGERATION EQUIPMENT**

BELL & GOSSETT COMPANY

Dept. BT-36, Morton Grove, Illinois

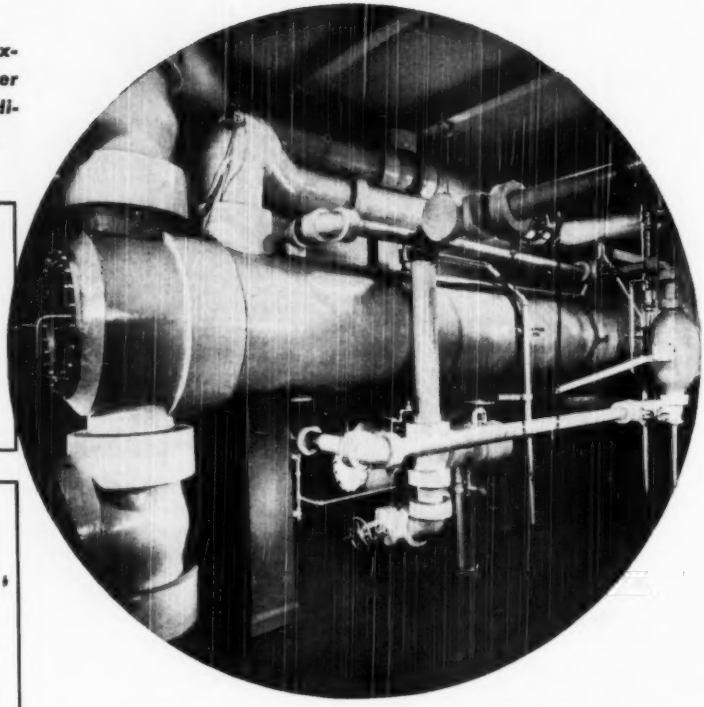
*Reg. U. S. Pat. Off.

CONSIDER THESE

3 Factors

for best results in feedwater heating

Here's why you can be SURE of exactly the right feedwater heater for your particular plant conditions when you consult G-R.



1

COMPLETE LINE . . . a type for every pressure and capacity . . . a selection of three designs of stationary heads . . . four designs of floating heads . . . straight-tube or U-tube bundles . . . any combination of condensing, sub-cooling, and desuperheating in a single shell.

2

EFFECTIVE DESIGN DETAILS... breech-block head for high pressure . . . pass partition sealing plates for prevention of leakage between passes . . . special baffles for steam guidance and prevention of tube erosion . . . special air and drain baffles for improving thermal efficiency.

3

60 YEARS OF EXPERIENCE in designing and building feedwater heaters . . . many hundreds of units in stationary and marine service.

This brief outline of G-R Feedwater Heaters is explained in detail in Bulletin 279, which graphically describes the many important features that are obtainable only in G-R designs. If you will write us your requirements, a copy of this informative bulletin, together with recommendations for your particular plant requirements, will be sent without obligation.

THE GRISCOM-RUSSELL CO., 285 MADISON AVE., NEW YORK 17, N.Y.

GR 232

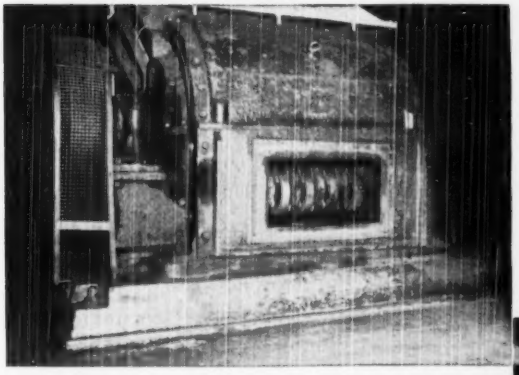
GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

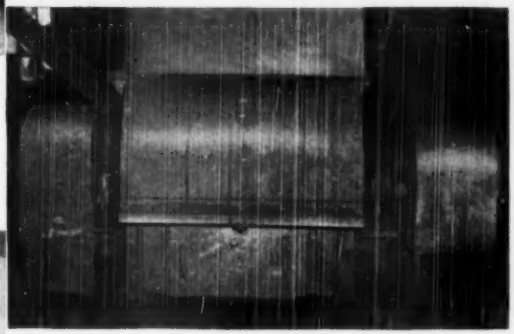
PROVED Champions of Quality...

AMERICAN CRUSHERS handle high tonnage for years with *amazingly* LOW *parts replacement costs!*

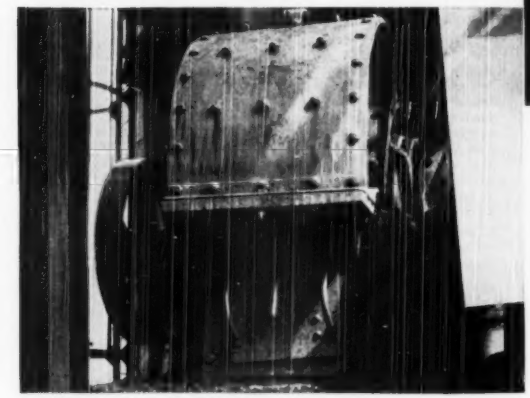
The most convincing proof of American Crusher *quality* can be obtained by comparing *cost of replacement parts needed* to *tons of coal crushed* in specific operations. Taken from an extensive independent survey of users· the following case analyses are typical—



A Power Plant in Illinois ▼
TYPE CRUSHER: AMERICAN 42S
YEARS IN SERVICE: SIX
TONNAGE HANDLED: 2,950,000
PARTS COST PER TON: $.0004



◀ **A Central Station in New Jersey**
TYPE CRUSHER: AMERICAN 42S
YEARS IN SERVICE: TWENTY
TONNAGE HANDLED: 6,000,000
PARTS COST PER TON: $.00025



◀ **An Industrial Power Plant in Ohio**
TYPE CRUSHER: AMERICAN 15C-1
YEARS IN SERVICE: NINETEEN
TONNAGE HANDLED: 182,000
PARTS COST PER TON: $.0000

These typically low parts cost figures are revealing—*they help to explain why American Crushers can reduce coal for less than 1 cent per ton even when all other operating costs are included!*

Write for Literature on AMERICAN CRUSHERS

American PULVERIZER COMPANY

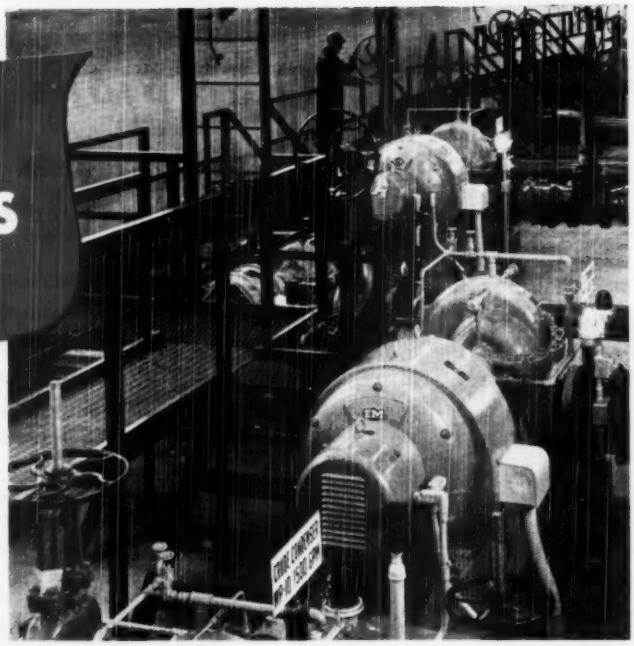
Originators and Manufacturers of Ring Crushers and Pulverizers

1349 MACKLIND AVE.
ST. LOUIS 10, MO.

E-M

Synchronous Motors

...SAVE POWER DOLLARS AT ILLINOIS REFINERY



Dollar savings in the books are being made by E-M Synchronous Motors on the floor of the Ohio Oil Company's new pump house addition to their refinery at Robinson, Ill. Operating at 80% leading power factor, these economical motors help boost the power factor of the generating station to nearly unity and cut reactive power costs.

Although the initial cost of leading power factor motors is slightly higher, Ohio Oil engineers consider it a sound investment in the interest of long range economy . . . for Synchronous Motors give assurance of lowering power costs while delivering constant, dependable motive power.

Motors precisely sychronized

Also featured in the new plant addition are E-M Synchronous Motor Controls, operating on the E-M developed Polarized Field Frequency system—the system which "senses" motor operating conditions and applies field excitation at exactly the right speed.

Part Winding Starting

Objectionable line voltage fluctuations are minimized, too, because Ohio Oil engineers specified part winding starting—also E-M pioneered.

Let E-M's new book, "Power Factor and What to do About It", show you how to cut your power costs by improving the power factor.

ELECTRIC MACHINERY MFG. COMPANY
1331 Tyler St., Minneapolis 13, Minnesota, U. S. A.

Above—Providing power factor correction are four E-M Synchronous Motors in the new pump house, two of which are seen above. Operating at 80% leading power factor these help offset the inductive load of the plant and minimize reactive power costs. The splash-proof construction of these motors protects windings and internal parts against dust, dirt and splashing liquids.

At Right—Operating on the E-M developed Polarized Field Frequency system, four of these magnetic controls pull their E-M Synchronous Motors into step at precisely the right instant for maximum torque and minimum voltage fluctuations, regardless of varying starting load conditions. The other four E-M controls provide full voltage starting for four induction motors. All controls feature Hi-Fuse protection which takes motors and controls off the line in less than ½ cycle should a short circuit occur.

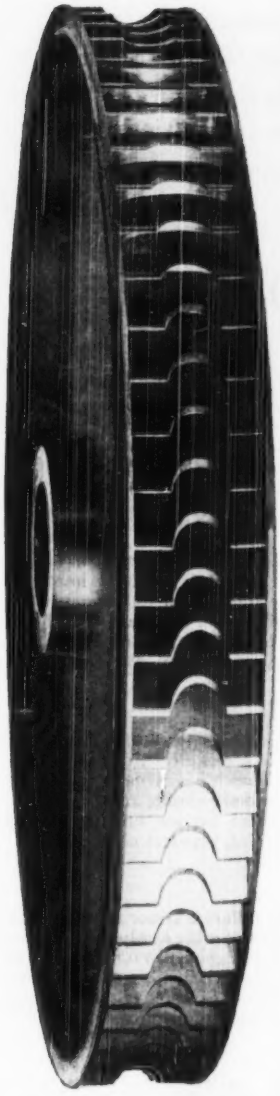
1100-TPA-2095

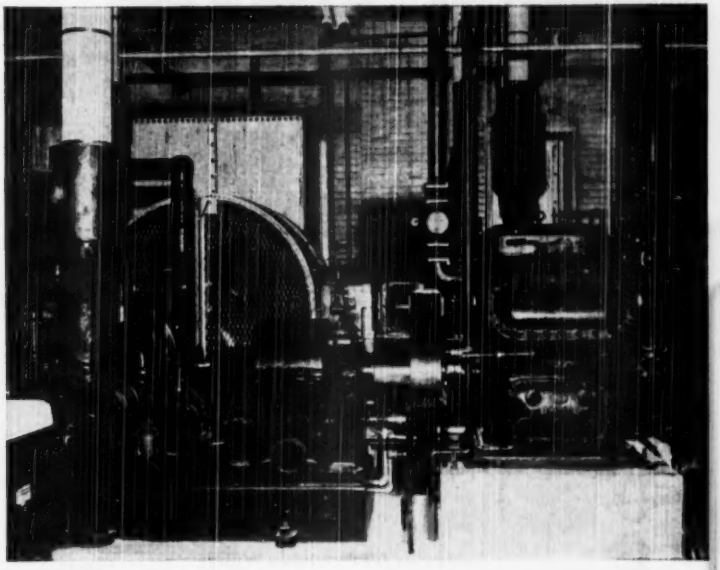
E-M

Specialists in

Big Motor Engineering

the Terry Turbine





Refrigeration Compressor Driven By Terry Turbine

AT HAMPDEN BREWERY

This 150 hp Terry Turbine — at the Willimansett, Mass. plant of the Hampden Brewing Co. — operates at 3800 rpm with a gear reducing it to 720 rpm. It is coupled to a 6 cylinder reciprocating compressor.

The installation is running on steam conditions of 120 psi — 0° superheat, and the steam to the turbine is automatically throttled to maintain a constant 30 psi back pressure for process and heating. The installation was developed by Fred Ophuls & Associates Consulting Engineers.

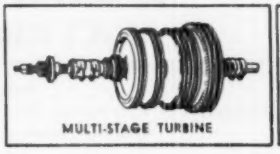
Get more information on the wide range line of Terry Turbines from your local District Representative. There's no obligation for a complete discussion of your specific requirements. Also send for Bulletin S-143 that gives full details.

THE TERRY STEAM TURBINE CO.

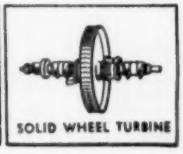
TERRY SQUARE, HARTFORD 1, CONN.

TT-1186

Terry



MULTI-STAGE TURBINE



SOLID WHEEL TURBINE

BIRD-ARCHER'S COMPREHENSIVE 8 POINT WATER TREATMENT SERVICE

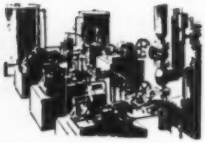
Even if your present water treatment methods **appear** satisfactory, it will pay you to look into Bird-Archer's 8-point water treatment service. Any or all of this comprehensive, efficient service is available to you. Talk to your Bird-Archer representative about it next time he calls. Or, write us now to arrange a consultation. No obligation, of course.

What Bird-Archer Does

1. Surveys Plant—Bird-Archer makes a complete study of plant operation involving the use of water or steam . . . checks present equipment and past performance.

2. Studies All Available Water — Starting at the source, Bird-Archer makes exhaustive analyses of water supplies.

3. Develops Treatment and Control Systems—On the basis of these comprehensive studies, Bird-Archer develops a complete system of treatment and control, including necessary operational changes.



4. Specifies Equipment that May Be Necessary — Bird-Archer determines whether installation of additional equipment will be helpful . . . analyzes benefits to be derived.

5. Furnishes Proper Chemical Treatments When Required—For more than a half century, Bird-Archer has manufactured specifically formulated treatments to solve individual problems.

6. Instructs Plant Staff—Plant personnel is carefully instructed by experienced technicians in the application of treatment and control . . . teaches simple, accurate test procedures.

7. Makes Periodic Check-Ups —To make certain that the recommended system is providing the best possible results, a Bird-Archer Service Engineer makes regular, personal check-ups.

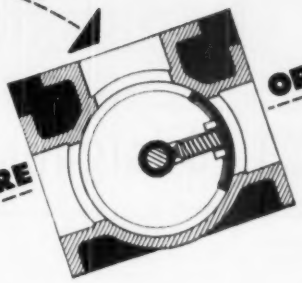
8. Offers a Laboratory Service for Scientific Analysis—Modern Bird-Archer laboratories, staffed by trained chemists, specialize in water analyses and research...check accuracy of plant control.

BIRD-ARCHER
WATER TREATMENT

THE BIRD-ARCHER COMPANY, 400 MADISON AVE., NEW YORK 17, N. Y.
PHILADELPHIA • CHICAGO
IN CANADA: The Bird-Archer Co., Limited, 503 McGill Building, Montreal, Canada
IN MEXICO: Calderas y Accesorios, S. A., Amsterdam 291, Mexico, D. F.

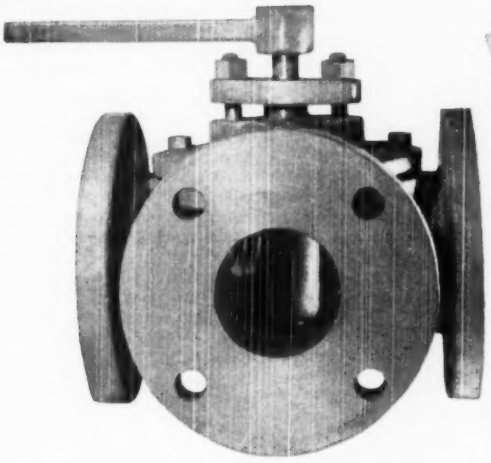
BA-187

BRING YOUR FLUID IN HERE



OR HERE . . .

AND LET IT COME OUT HERE



with this amazingly simple

HONEYWELL TRANSFER VALVE

HERE is true simplicity . . . sturdy, practical, efficient. A minimum of parts in this Honeywell Transfer Valve makes it easy to maintain, easy to clean. (Complete disassembly requires only the removal of four nuts.)

If the fluid to be diverted is thick, or if it carries suspended solids . . . investigate this Honeywell Transfer Valve. It saves money, too . . . often replacing two gate valves and associated fittings. Available in Cast Iron, Bronze, and Galvanized Cast Iron, with Bronze, Iron, or Monel trim. Sizes 2" and up—two way or straight through—screwed or flanged.

Call in your local Honeywell engineer for detailed information about this valve or such other Honeywell Control Specialties as Hi-Lift Hand Control Valves, Liquid Level Devices, Steam-Jacketed Rotary Cocks, and the Honeywell Space-Saving Bypass.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 1900 Windrim Avenue, Philadelphia 44, Pa. Offices in more than 80 principal cities of the United States, Canada and throughout the world.

Honeywell

VALVE PRODUCTS

Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

Expansion Joint of the Month

Designed to Meet a Need

UNIVERSAL EXPANSION JOINT

Zallea Stainless Steel Universal Expansion Joints, capable of absorbing combined axial and lateral movements in high temperature lines, have wide application in refineries, chemical, public utility and other industrial plants where it is difficult to anchor the piping and isolate the axial movement of the line from the lateral. The Universal Joint, absorbing movement in all planes simultaneously, reduces the number of anchors required, and also reduces the loads on the supporting steel work, simplifying the erection of today's complex piping. Each Zallea Stainless Steel Universal Expansion Joint is specifically designed to fit the requirements of each individual application. Send us your problem, stating the amount of axial and lateral movement anticipated, the maximum pressure and temperature to be encountered. This involves no obligation, of course. And, ask for Catalog 47—It's free!

ZALLEA BROTHERS
814 Locust Street
Wilmington 99, Delaware

THE Zallea Stainless Steel Universal Expansion Joint was designed to meet the need for a medium capable of absorbing movement in high temperature lines *in any direction*—axially, laterally, angularly, or any combination of these. Illustrated here are the many ways in which this versatile joint may function. In each case, the rectangle shows the original position of the expansion joint.

CASE 1—Axial Movement Only

A Universal Expansion Joint is usually not required unless this axial movement is combined with lateral or angular movement. However, it may be used for axial movement only where the traverse is such as to require more than one joint, and it is not possible to install an anchor between the two joints. In such cases, the tie rods take the place of an intermediate anchor.

CASE 2—Lateral Movement Only

The corrugated element on one end closes on one side and opens on the other, permitting a slight angular deflection. The corrugated element on the other end is similarly deflected in the opposite direction. The longer the section of pipe between the two corrugated elements, the greater the lateral deflection. Notice that the flanges remain parallel indicating that there is no bending in the adjacent pipe. Here the tie rods take the place of pipe anchors.

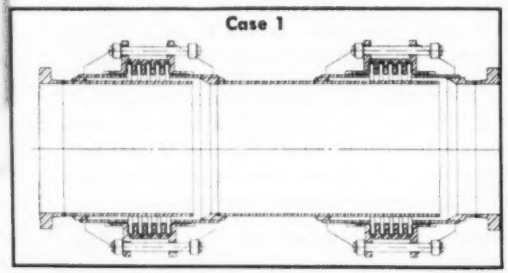
CASE 3—Axial and Lateral Movement

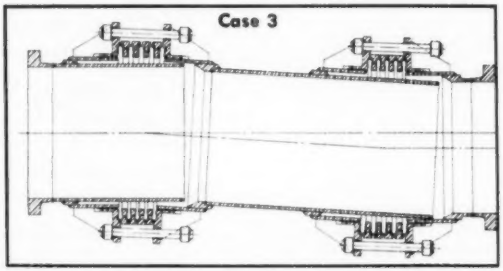
This is a combination of the movements illustrated in Cases 1 and 2, the most frequent application for Zallea Stainless Steel Universal Expansion Joints.

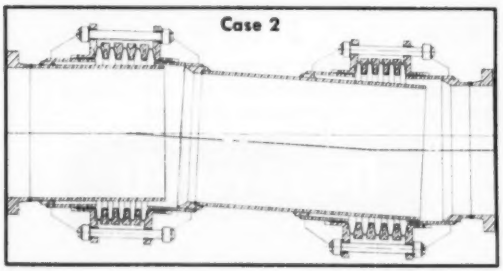
CASE 4—Axial Movement and Angular Rotation

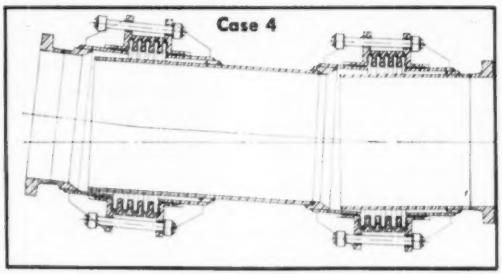
Here axial movement combines with angular rotation. Notice that flanges do not remain parallel, indicating that the pipe attached to the left end of the joint must bend, or that there is another joint at the other end of this pipe to compensate for the angular rotation. Axial and lateral movement may also be combined with angular rotation.

The limit rods shown in all cases are an essential part of the Zallea Stainless Steel Universal Expansion Joint. They are designed so that any two of the four rods will withstand the full line pressure in the event of failure of the anchors on the piping. They also distribute the movement equally between the two corrugated elements.









(Advertisement)

WHEN YOU BUY A COAL CRUSHER

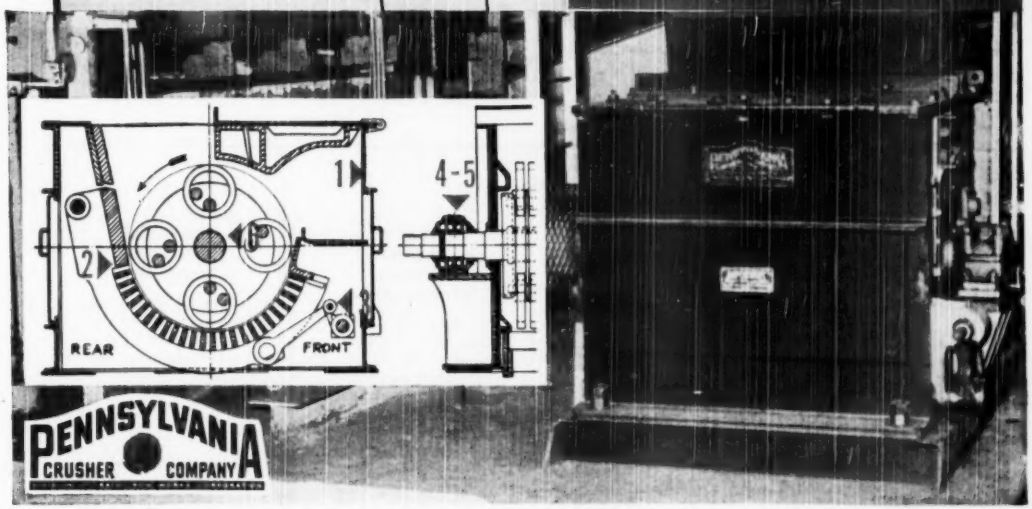
This *Check-off* List Can Help You Get Your Money's Worth

Important for Long Service, Low Maintenance, and Trouble-free Operation	Crusher Mfgr. and Type	
	"PENNA." RING-TYPE	Others
1 **Rolled Steel Frame:** Eliminates failures caused by hidden flaws in *cast* frames.	✓	
2 **Full Cage and Breaker Plate Adjustment:** Compensates for wear; operator gets maximum crushing life available in hammers and grate bars.	✓	
3 **Positive Cage Adjustment To or From Rotor:** Quickly, easily set with ratchet wrench—no chains or grappling hooks needed.	✓	
4 **Heaviest-duty, Anti-friction Roller Bearings:** Only *heaviest*-duty type assure long life; ask for sizes, then compare.	✓	
5 **Floating Bearing on Side Opposite Drive:** Absorbs shaft length variations caused by temperature changes, eliminating tremendous stresses and premature failures.	✓	
6 **Forged Steel Rotor Shaft:** The only construction assuring long service under severe operating conditions.	✓	

It's wise to remember that the purchase price of a crusher is only part of its final cost. Unless the type you select gives you long, trouble-free service at low maintenance, you may discover that the crusher with the lowest price tag soon eats up this price differential, and constant expense piles up month after month. To help you avoid such a predicament, we've checked some of the features to look for in the crushers you may be considering. Many operators who have been misled by first cost say, "For preparing pulverizer and stoker coals, Pennsylvania's your best buy in the long run." We'll gladly send you Bulletin 9001 containing additional details.

PENNSYLVANIA CRUSHER COMPANY, *Division of Bath Iron Works Corporation,* 1714 Liberty Trust Building, Philadelphia 7, Pennsylvania. Representatives in New York—Boston—Pittsburgh—Birmingham—Roanoke—Detroit—Chicago—St. Louis—Crosby, Minn.—Los Angeles—London, England.

PENNSYLVANIA Ring-Type GRANULATOR



Special Note: The Crushers used at the Sunbury Station of the Pennsylvania Power and Light Co. are two Pennsylvania Ring Type Granulators.

RECORDING FULSCOPE® CONTROLLER

For desuperheaters, or for any close, accurate control of temperature, pressure, flow or liquid level. Quickly adapted to any operating requirements.

RECORDING THERMOMETER OR PRESSURE GAUGE

Ideal wherever you need a record of pressure, temperature or a combination of both. Accurately records steam and feed water temperatures and pressures or oil, air and flue gas temperatures.

TAYLOR DIAL THERMOMETER

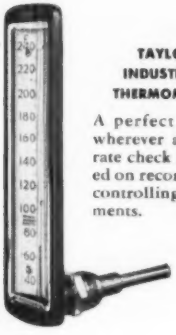
For transformers, coal-air mixture in powdered coal ducts, air compressor discharge, turbine and generator bearings. Available with electric alarm devices.

SAVE STEAM

with Taylor Cost Cutters like these

STOP those dollars from going up in steam! Let Taylor Instruments help you get credit for increasing operating efficiency and cutting costs. Select what you need from our complete line of instruments for accurate measurement or control of temperature, pressure, flow and liquid level. Ask your Taylor Field Engineer! Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY



TAYLOR INDUSTRIAL THERMOMETER

A perfect choice wherever an accurate check is needed on recording or controlling instruments.

TAYLOR SELF-ACTING TEMPERATURE CONTROLLER

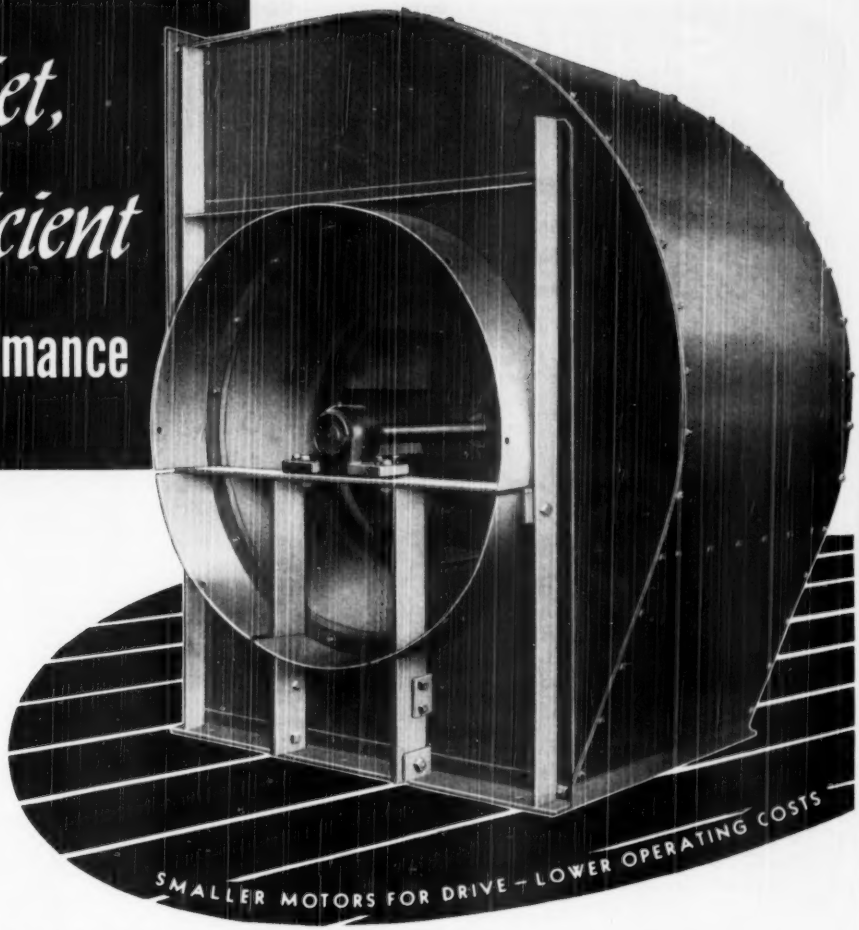
For dependable control on hot water storage tanks, air compressor jacket water.

ARMORED ETCHED STEM THERMOMETER

Ideal wherever you need a test check on temperatures. Also available in unarmored types.

® Registered Trade Mark

Quiet, Efficient Performance



ANNOUNCING Type NH Fans *for Ventilation, Air Conditioning, and Industrial Services*

A new line of fans with the same **HEAVY-DUTY** construction found in all Clarage equipment! . . . and with **money-saving advantages,** compared to older, less modern designs.

1. Operating speeds that allow the selection of relatively high speed motors, resulting in reduced motor and drive costs.

2. A full self-limiting horsepower characteristic permitting the use of smaller motors with safety — **another economy** in over-all installation costs.

3. Engineered for quiet, efficient performance, Clarage Type NH Fans are **more than O.K.** no matter how exacting your job.

Write us for Bulletin 220. It will pay you to know about this newest Clarage development.

CLARAGE

—HEADQUARTERS for Air Handling and Conditioning Equipment

CLARAGE FAN COMPANY

KALAMAZOO, MICHIGAN

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

Specify Honan-Crane

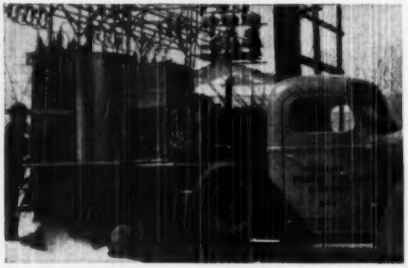
OIL PURIFIERS FOR UTILITIES AND POWER PLANTS

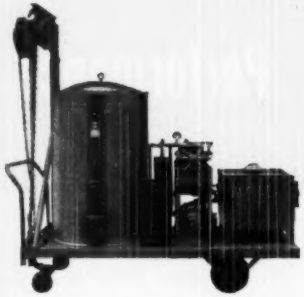
"R" Specify

Honan-Crane "R" Type Purifier for INSULATING OILS

Consistent Honan-Crane purification removes acids, moisture and sludge from insulating oils in transformers and circuit breakers. Protects equipment . . . reduces power failures . . . pays for itself in lowered maintenance costs.

Honan-Crane "R" Type Mobile Purification Unit is first choice among utilities and power plants requiring capacities of 100 to 200 GPM. Ideal for use in the field or at a central station. *For complete information, write for Bulletin "R".*



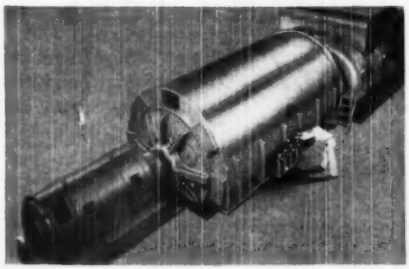


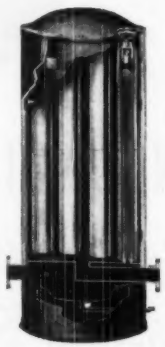
Two Honan-Crane "R" Type Purifiers are used by Omaha Public Power District to maintain oil in more than 1,000 transformers in 300 substations . . . as well as large banks of transformers and about 200 small units at the power plant itself.

"M" Specify

Honan-Crane "M" Type Purifiers for TURBINE and DIESEL OILS

Honan-Crane "M" Type Purifier is low-cost protection from the abrasive and acid action of contaminated oil. High-flow, multiple cartridge "M" Type unit maintains oils in original clean, safe condition . . . keeps neut. number and steam emulsion number within desired limits. Design permits easy changeover from Palconia cartridges (cellulose fiber) for removal of solid contaminants and abrasives . . . to Cranite cartridges (specially processed fullers earth) for removal of suspended fines and products of oxidation (asphaltenes, acids, gums and resins). *For complete information, write for Bulletin "M".*





The Ohio Public Service Company has used Honan-Crane oil purification equipment continuously for many years . . . now has Honan-Crane installed in five of its big Ohio generating stations which produce a total of 470,000 kilowatts.

For Equipment Bulletins and full information on Honan-Crane Oil Purifiers and Handling Equipment, write to . . . . . .

HONAN-CRANE CORPORATION

100 SUPERIOR AVENUE, LEBANON, INDIANA

A Subsidiary of **HOUDAILLE-HERSHEY CORP.**

HERE'S *Insulation* AT ITS BEST!

In the illustration above, Mica-Glas is being visually inspected and gauged for exact thickness. Bond content, dielectric strength, slippage and other characteristics are very carefully checked during manufacture and on a final inspection before shipment.

Mica-Glas, which is built up of hand-laid premium mica with glass cloth backing, has high dielectric strength, is resistant to heat and impervious to moisture.

With either long-life synthetic resin or silicone bonding, it is available in sheets, rolls and tape, in standard thicknesses and widths. In addition, Mica-Glas can be obtained in .0035" thickness—ideal where a minimum of space is available, and for turns of small radius.

To insure uniform insulation value, National impregnates the glass cloth in a National-designed coating tower which meters and cures the varnish with uniform accuracy. Mica splittings are applied under close control and are bonded tenaciously to the glass cloth. When you use Mica-Glas you *know* your electric windings are using the best.

NATIONAL MICA-GLAS INSULATION
TRADE MARK

Use Mica-Glas, and other National insulation, for *known high value*. Some of the world's largest manufacturers of electrical equipment standardize on it.

NATIONAL ELECTRIC COIL COMPANY
COLUMBUS 16, OHIO, U. S. A.

Good plumber + good tools + GOOD PIPE = GOOD JOB!

7 POINTS OF UNIFORM GOODNESS IN YOUNGSTOWN STEEL PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

ON a radiant heating job, it's a pleasure to work with Youngstown pipe. It bends readily to a true arc without flattening. That's because it is uniformly soft and ductile, and soundly welded in manufacture by the Youngstown continuous-weld process. The name Youngstown, rolled into every length, is your assurance that it's GOOD PIPE.

QUALITY · YOUNGSTOWN · SERVICE

Youngstown STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices — Youngstown 1, Ohio

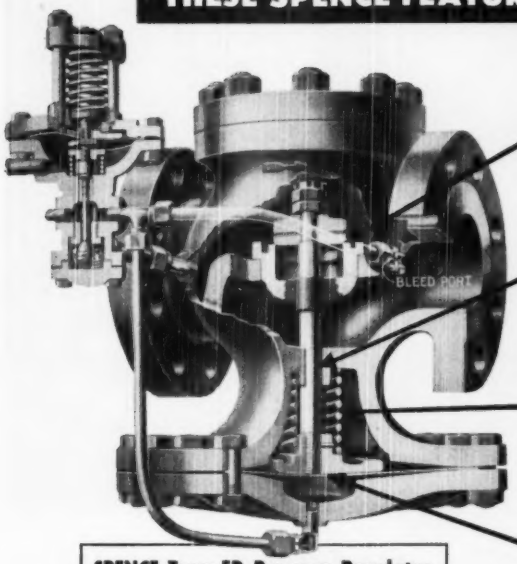
Export Office-500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS · WIRE · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · HOT AND COLD FINISHED CARBON AND ALLOY BARS · RODS · SHEETS · PLATES · CONDUIT · RAILROAD TRACK SPIKES.

HERE'S PROOF

You Can Cut Costs of Pressure and Temperature Control

THESE SPENCE FEATURES SHOW YOU HOW



SPENCE Type ED Pressure Regulator

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

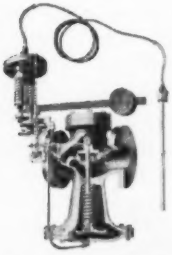
PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

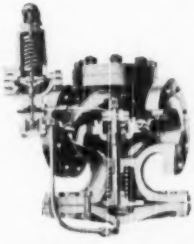
LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

YOU BENEFIT by these and many other Spence features that assure *accurate, dependable* regulation year after year. That means *less down-time, less time and money wasted on replacement of parts.*

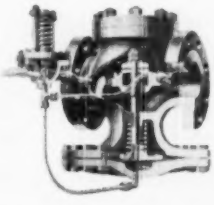
Spence Pressure and Temperature Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* Only minor adjustments are needed to switch any Spence Regulator from one service to another.



Type ET150 Temperature Regulator—Tops in performance for both storage and instantaneous heaters.



Type EN Differential Regulator—Accurately controls differential between fluid delivered by regulator and some other source of pressure connected to the pilot spring chamber.



Type EQ Back Pressure Regulator — Completely packless, pilot operated for accurate control of the initial pressure.

These Companies Have Profited with SPENCE!

The Springs Cotton Mills
Ford Motor Company
Pennsylvania Power & Light Company
Jones & Laughlin Steel Corporation
National Tube Company
The Atlantic Refining Company
Great Lakes Steel Corporation
Todd Shipyards Corporation
Land O'Lakes Creameries, Inc.
General Electric Company
R. J. Reynolds Tobacco Company
Ohio Edison Company

and thousands of others

SPENCE ENGINEERING COMPANY INC.
WALDEN, NEW YORK

Spence

GARLOCK PACKINGS and GASKETS

made of *Teflon**

Extremely Inert to Chemicals; Heat Resistant; Tough; Durable

GARLOCK packings and gaskets made of *Teflon* solve the problem of sealing against acids and chemicals of all kinds.

These *Teflon* products, fabricated in the GARLOCK factories, are unaffected by any acid and are highly resistant to all organic solvents and alkalies. They operate at temperatures from below −90° F. up to +500° F. and have high mechanical strength and a low coefficient of friction within that temperature range.

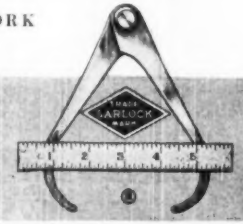
For use on valves, pump rods or shafts and any other equipment in the chemical industry, GARLOCK produces several types of braided and molded *Teflon* packings. For gasketing flanged joints of all kinds, including glass and porcelain flanges, *Teflon* envelope gaskets or solid *Teflon* gaskets are available in required sizes and shapes.

To avoid frequent shut-downs and reduce your packing costs, use GARLOCK packings and gaskets made of *Teflon* on all your equipment handling acids or chemicals. *Write for pamphlet.*

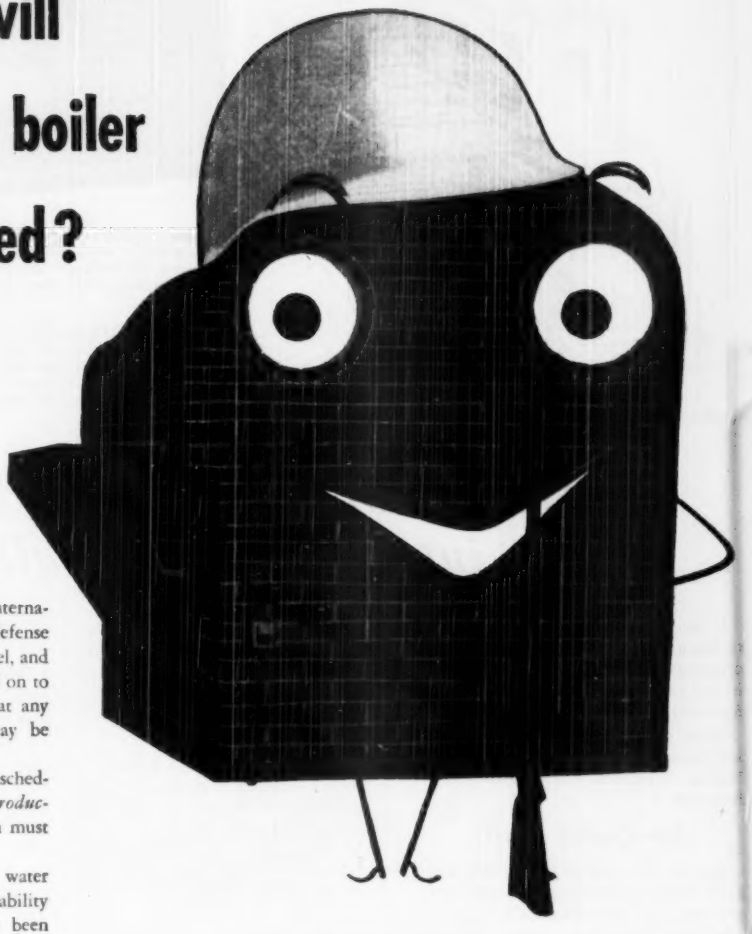
THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK



When will your spare boiler be drafted?



AS LONG AS the present international situation continues, defense production will be at a high level, and almost every plant may be called on to participate—which means that at any moment your 'spare' boiler may be needed in regular service.

Under these circumstances, unscheduled boiler outages mean *lost production*, at a time when production must be kept high.

Proper conditioning of boiler water is a major factor in boiler availability—and Hall Laboratories have been leaders in boiler water conditioning for more than a quarter of a century. They are prepared to recommend procedures which, in your specific situation, will give most desirable results at minimum investment and lowest operating costs.

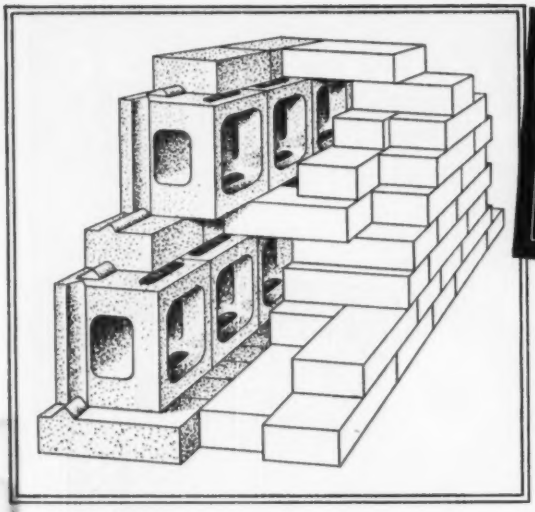
Hall Laboratories are not, however, limited to boiler water conditioning. Hall also offers *plant-wide* water service, for every problem concerning the use of water in industry comes within the scope of Hall activities. May we send you a copy of the new Hall bulletin "Your Most Important Raw Material"?

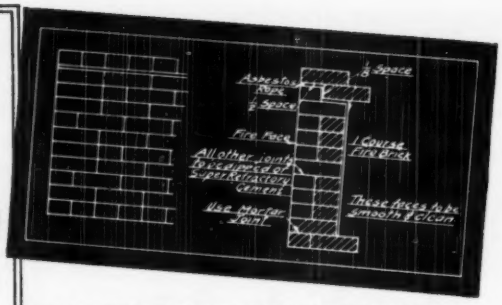
Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

HALL *plant-wide* WATER SERVICE

BOILER WATER CONDITIONING

PROCUREMENT, TREATMENT, USAGE AND DISPOSAL OF INDUSTRIAL WATER




Asbestos Rope ½ Space
½ Space
Fire Face
All other joints to be grouted w/ Superrefractory Cement
Use Mortar Joint
1 Course Fire Brick
These faces to be smooth & true

ILLUSTRATING CONSTRUCTION OF SOLID WALL with up to 9 courses of Norton Crystolon bricks laid with Norton Alundum cement. Such walls pay for themselves many times over because of freedom from clinker adherence and lower labor costs for cleaning.

AIR-COOLED WALLS of Norton Type A Crystolon* Hollow Blocks and Crystolon Bricks laid with Norton Alundum* cement far outlast fire-brick and other types of refractory walls. Norton Type B (T-shaped) and Type C (U-shaped) blocks and bricks are also available in Crystolon refractory for replacement purposes.

How to build EXTRA LIFE *into your boiler walls*

If fire-clay brick walls are causing you to shut down boilers frequently for repair of spalled, eroded or cracked refractories, it will pay you to switch to special refractories made of silicon carbide.

Many power plants report longer life and lower over-all costs from the use of Norton Crystolon silicon carbide refractories.

Air-Cooled Walls

Norton Crystolon hollow blocks and solid bricks with mating tongues and grooves have been designed to simplify the construction of air-cooled walls in boiler furnaces. While the unique design of these blocks makes a hit with masonry crews, it's the physical and chemical properties of Norton Crystolon refractory that really pay off.

Made of dense silicon carbide with a minimum of refractory bond, Norton Crystolon shapes are highly resistant to the four common causes of boiler wall failure. (1) Being highly refractory, they successfully resist temperatures up to 2900°F. (2) They're so dense that they effectively resist slag penetration. (3) Resistance to clinker adhesion is also high. However, if clinkers do adhere to a limited extent, their rugged strength permits removal without damage to the surface of brick or block. (4) Since silicon carbide is an extremely hard abrasive in its own right, Crystolon shapes are not noticeably affected by abrasion, even that caused by the moving fire bed of stoker-fired furnaces.

Solid Walls

The same advantages that make Crystolon hollow blocks such a good investment for air-cooled walls also apply to Crystolon bricks for solid walls. Their longer service and lower maintenance cost more than compensate for the cost differential between them and ordinary fire brick.

For best results, not less than five courses of Crystolon brick should be used in any boiler furnace. Only in the case of unusually thin fire beds or other exceptional operating conditions are fewer courses satisfactory.

Alundum Cement

Whether you decide on air-cooled or solid walls of Crystolon refractories, Norton RA-1019 cement is recommended for laying up the blocks or bricks. This cement is chemically stable and assures a very strong bond. Used as a slip for making dipped joints, this fine-grained aluminum oxide cement matures at 1850°F and withstands temperatures up to 3100°F.

Write for Bulletin 862

For more complete information about Crystolon shapes and Alundum cement, consult your nearby Norton representative, or write direct for Bulletin 862. NORTON COMPANY, 600 NEW BOND ST., WORCESTER 6, MASS.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON

TRADE MARK REG. U. S. PAT. OFF.

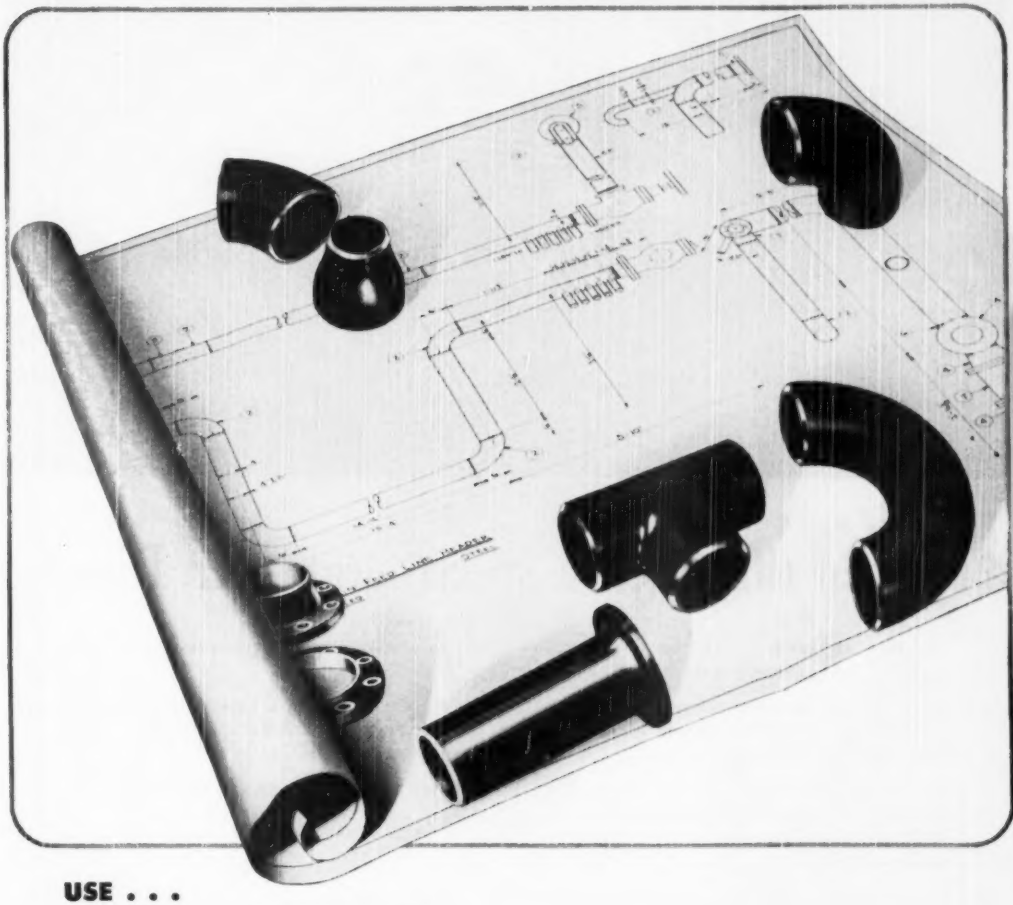
Making better products to make other products better

Special REFRACTORIES

Canadian Representative

A. P. GREEN FIRE BRICK CO., Ltd. TORONTO, ONTARIO

TO DO A BETTER PIPING JOB . . .



USE . . .

GLOBE PRECISION PROCESS SEAMLESS WELDING FITTINGS

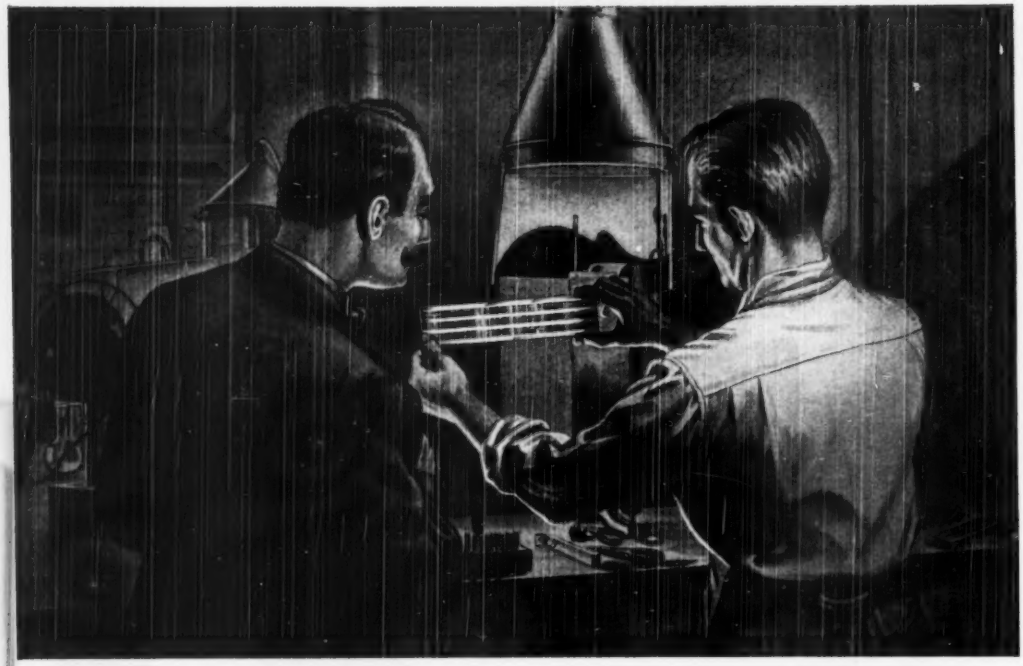
When you specify and use Globe Welding Fittings you have the product of an organization with unusually broad metallurgical experience. Globe's precision-process method of production reaches back to the manufacture of the Globe seamless tubes themselves which are the "raw material" of Globe welding fitting fabrication.

GLOBE STEEL TUBES CO., Milwaukee 4, Wisconsin

Chicago • Minneapolis • Cleveland • Detroit • New York • Philadelphia St. Louis • Tulsa • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — carbon — alloy — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

Send for the Globe Welding Fittings Catalog—and look to Globe as a preferred source of supply.



Look at this Exide spectrogram, Mr. Diesel

See how accurately . . . and to what minute degree . . . every element in the lead is measured.

What and *how much* are important to know. For a very small percentage of certain elements can affect battery performance and life.

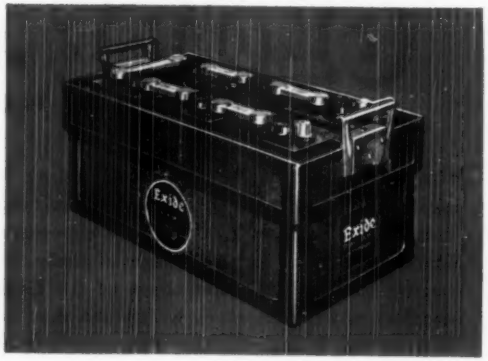
Yet spectrum analysis is but one example of the great care taken by Exide to produce a battery with the mighty cranking power that Diesel starting demands.

Exide Batteries have that power. Test after test proves it. Especially the final performance tests, which are tough, rugged, brutal . . . much more severe than the battery will have to meet in service.

Exide Diesel Cranking Batteries pass those tests with credits to spare. That's why you can count on Exides for a quick breakaway and a high cranking speed.

It's also the reason why so many makers and users of Diesel engines choose Exide Batteries . . . why these batteries are best for you.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto



DEVELOPMENT WORK NEVER CEASES in improving the performance of Exide Batteries. Our staff of engineers, chemists, metallurgists, physicists and technicians is the largest in the battery industry.

"Exide" *Reg. Trade-mark U. S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 62 YEARS . . . 1950

NEW

SERIES 12100*

FORGED STEEL

DROP

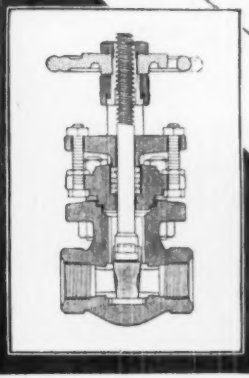
Vogt

BOLTED BONNET
BOLTED GLOUD

150-800 POUND

GATE VALVES

SIZES 1/4" to 2"



*Series 12100

CARBON STEEL } 800 Pounds @ 750° F.
1500 Pounds Cold Non-Shock

For 150-800 pounds service • Round Bolted Bonnet • Bolted Gland • Gasket or Ground Joint • Outside Screw and Yoke • Renewable Seat Rings • Solid Wedge — Slotted Type • Rising Stem 11½-13% Chrome Stainless Steel Trimmings • Sizes 1/4" to 2" inclusive.

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POWER THROB
FLEXINEERING ELIMINATES VIBRATION ON TUG DIESEL EXHAUST
. . . PROVIDES SMOOTHER POWER . . . COOLER OPERATION
When the giant 16 cylinder, 1750 horsepower diesel engine of the new tugboat, Grace Moran, roars into action, there's a smooth purr of silky power. And one of the keys to this vibration-free operation is "flexineering"—the scientific engineering of flexible metallic tubing to industry's specific needs.
From the exhaust to the stack is a five foot length of Penflex air jacketed 14 inch, interlocked, flexible metallic tubing which achieves a circulation of air and an efficient cooling action.
Tough, rugged tubing that keeps exhausts as tight as a pipe . . . yet provides all of the flexibility necessary to "soak up" the constant vibration.
In the power field—whether it is on exhaust lines, air lines or the many other places where tubing is used—you will find Penflex engineers ready to help you solve your problems. Penflex tubing is available in bronze, galvanized steel and stainless steel . . . in sizes from ⅛ inch I. D. to 24 inch I. D. Write for your copy of "Flexineering."
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Philadelphia 42, Penna.
Branch Sales Offices
BOSTON • NEW YORK • CLEVELAND
CHICAGO • HOUSTON • LOS ANGELES
penflex... HEART OF INDUSTRY'S LIFE LINES

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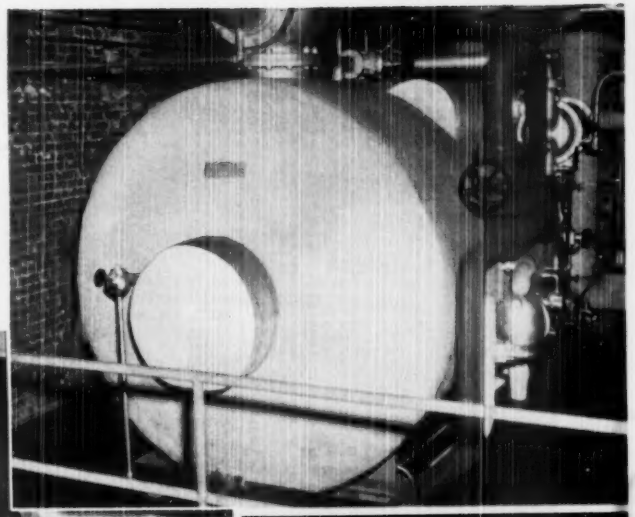
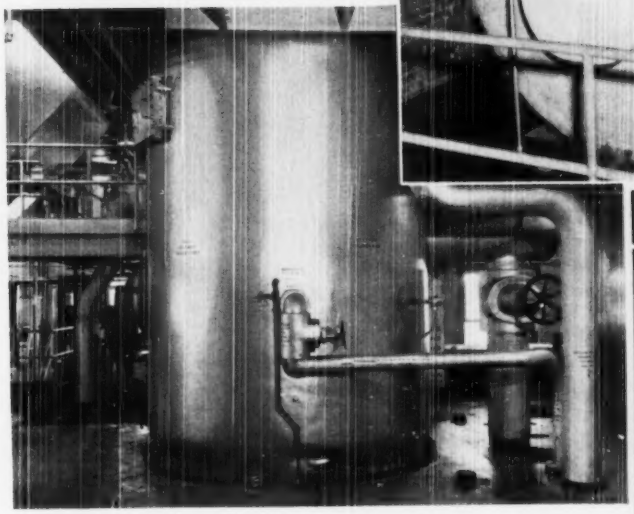
Central Station

DEAERATING EQUIPMENT

by CONSECO



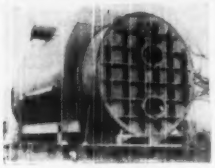


HORIZONTAL

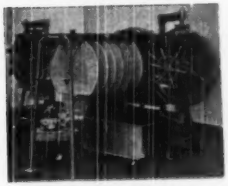
VERTICAL

BOILERS

EVAPORATORS



CONDENSERS



REFINER FILTERS

The two units shown here are installed in the central station of a large New England public utility. Each unit represents the very latest in engineering development and was designed and built by CONSECO. They are typical examples of CONSECO'S long, specialized experience on heat transfer equipment of all kinds.

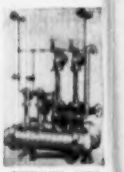
VERTICAL

This vertical, tray type Deaerating Feed Water Heater delivers 588,000 lbs. water per hour at a maximum of .005 cc per liter oxygen concentration. It is fitted with vent condenser and integral storage system. It operates with extraction steam.

HORIZONTAL

The horizontal unit illustrated is a tray type Conseco Deaerating Feed Water Heater delivering 150,000 lbs. of water per hour at maximum .005 cc per liter oxygen concentration. It was designed with an internal tray section having special construction arrangements to meet requirements of limited headroom.

CLOSED HEATERS



STEAM JET AIR EJECTORS

Send for illustrated literature. Ask Conseco Engineers for recommendations on condenser and heat exchanger equipment to meet your requirements and guaranteed to meet or exceed performance specifications.

CONSECO

Condenser Service & Engineering Co.

HOBOKEN, N. J.

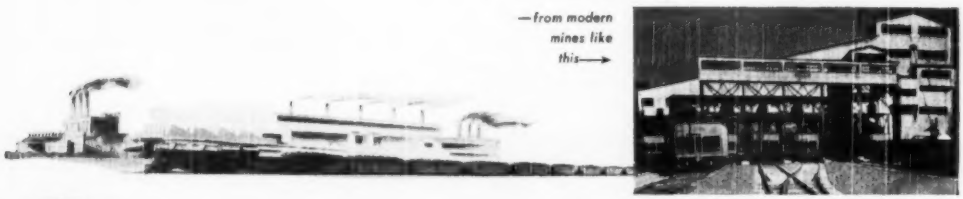
Bituminous is basic—the mainspring of America's might. Far-thinking executives—those who study existing facts, consider long-term possibilities, and prepare for emergencies—know this. So the vital decision so often made is, "build for bituminous."

Amid the uncertainties of the future is this fact: In the area served by the Baltimore & Ohio, lie vast, untapped reserves of excellent bituminous coals. They're in wide variety, and highly mechanized mines can produce them properly prepared for every requirement of modern industry.

Year after year, tireless research has made bituminous increasingly dynamic. Its further possibilities are tremendous. B&O, too, is constantly seeking better ways of serving the bituminous industry and its customers. In recent years, millions of dollars have been spent to improve B&O facilities for bituminous distribution.

Here's real help for bituminous in guaranteeing the greatness of American industry for years to come. *Ask our man!*

BITUMINOUS COALS FOR EVERY PURPOSE



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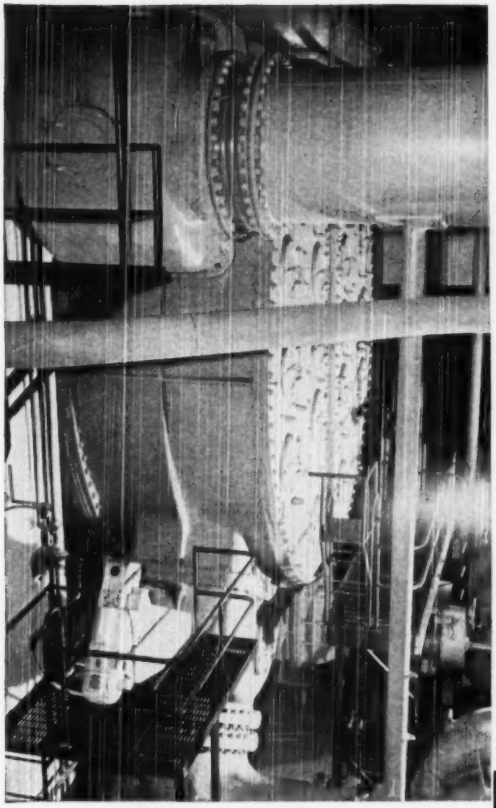
Constantly *doing things*—better!

"SELF-CLEANING" CONDENSER

Eliminates 2 to 3 HOURS Daily Down-time



HERE'S HOW THE "REVERSE FLOW" PRINCIPLE WORKS →

Both halves of this Dual Bank Condenser work the same but independently of each other.

Left Side: Water enters divided water box at valve chamber A, with left port open. It flows through pass B to end of condenser, back through pass C and out through upper port of D.

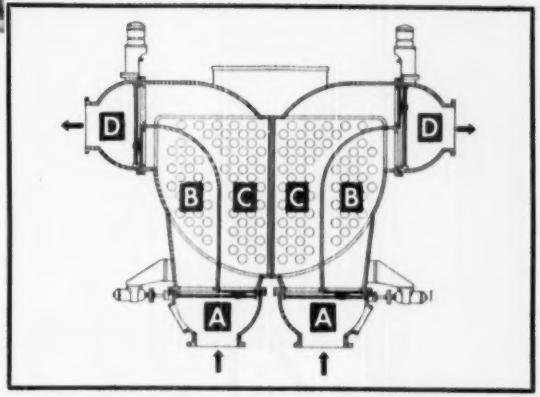
Right Side: Flow is reversed: Valves at inlet A and discharge D are changed to permit water to flow through C and back through B in the opposite direction, then out through lower port of D.

At Plant Atkinson, Harryat, Georgia, the Georgia Power Company draws circulating water from the Chattahoochee River. The inevitable sand, gravel, twigs and leaves used to clog condenser tubes and tube sheets in a matter of hours. Before the installation of a C. H. Wheeler Reverse Flow "Self-Cleaning" Condenser, it was a two- to three-hour job every day to remove anywhere from ½ to 2 yards of debris by hand. During this time, it was necessary to drop the load on the turbine to about half in order to operate against excessive back pressure.

Since September 5, 1949, when a C. H. Wheeler "Self-Cleaning" Condenser was installed, there hasn't been a single shut-down for cleaning. The Reverse Flow mechanism works flawlessly 24 hours a day, with 70,000 gallons per minute of river water passing through. The only cleaning is done by means of the electrically operated valves that reverse the flow of water through the condenser without interfering in any way with plant operation. This is done as often as necessary in a matter of minutes.

Through eliminating down-time for condenser cleaning, approximately *one month* of full capacity operation is added to the service of one of the four 60,000 KW turbo-generators in this 240,000 KW plant.

You, too, can benefit by C. H. Wheeler Engineering. Whether or not you need the self-cleaning Reverse Flow feature, it will pay you to "Investigate C. H. Wheeler Condensers before you Invest."



C.H. Wheeler OF PHILADELPHIA

STEAM CONDENSERS—STEAM JET EJECTORS—COOLING TOWERS—VACUUM REFRIGERATION—HIGH VACUUM PROCESS EQUIPMENT—MICRO-PARTICLE REDUCTION MILLS—MARINE CONDENSERS & EJECTORS—DECK MACHINERY

C. H. WHEELER MANUFACTURING CO., 1800 SEDGLEY AVE., PHILADELPHIA 32, PA.

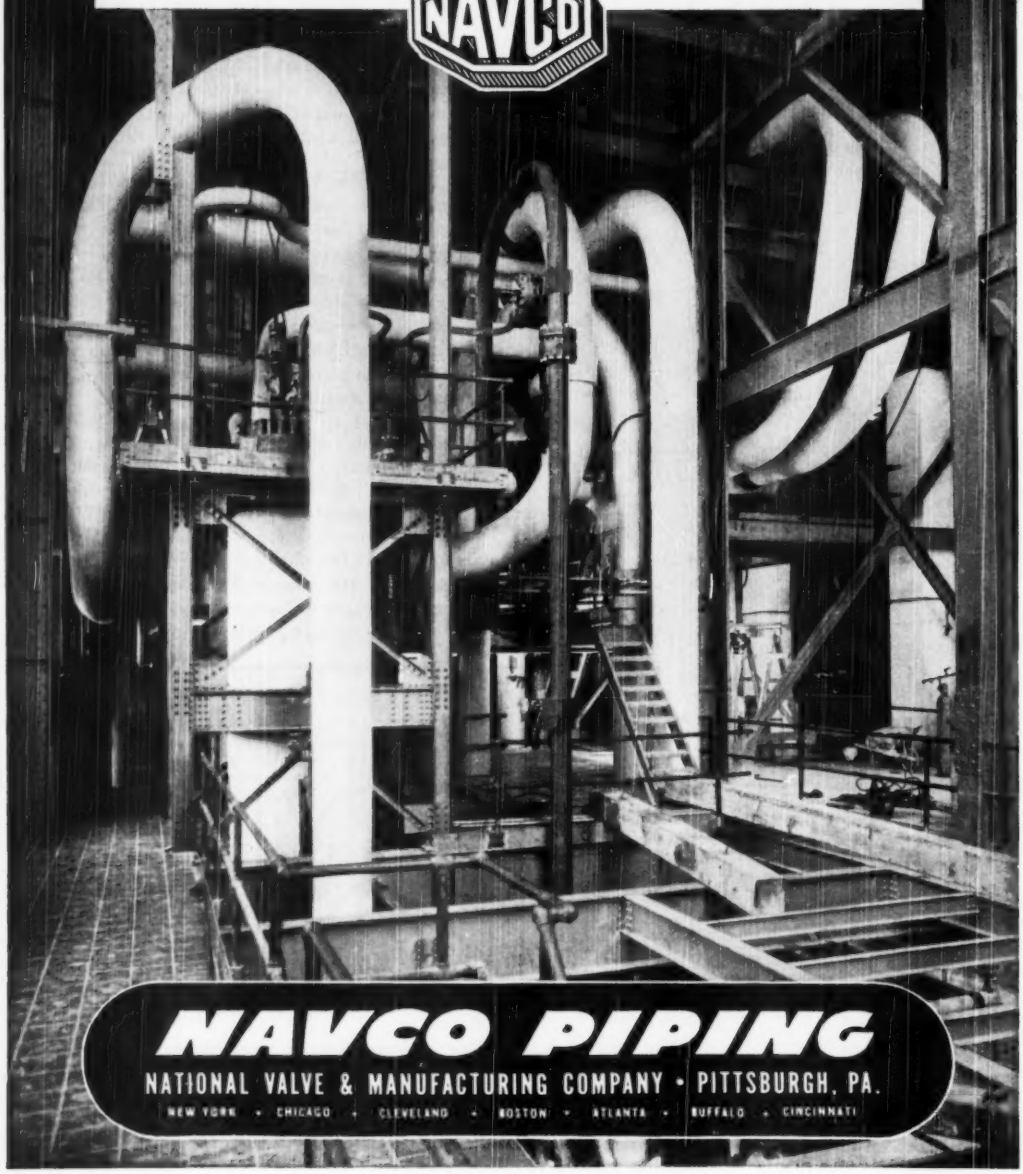
REPRESENTATIVES IN MOST PRINCIPAL CITIES

It pays to get NAVCO'S "Know How" and experience in High Pressure and High Temperature piping

For almost half a century Navco has specialized in the fabrication and erection of Piping Systems for the highest operating conditions.

The experience gained throughout that period is your assurance of obtaining from Navco, a Piping System of the highest order.

NAVCO



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PREVENT
ENCRUSTATION
OF VALUABLE EQUIPMENT

Unretouched photograph showing encrustation of turbine blade section.

USE DEARBORN POLYAMIDE ANTI-FOAM NO. 659

This section of turbine of a large generator was replaced because of blade fouling caused by improperly and inadequately treated steam boiler water.

Dearborn Polyamide Anti-Foam No. 659 would have substantially lengthened the life of this costly part . . . would have eliminated the time devoted to repair of the generator.

If you use steam in your plant, it will pay you to investigate Polyamide Anti-Foams . . . an exclusive Dearborn development that produces purer steam—eliminates scale formation in feed lines, heaters and economizers—prevents carry-over of suspended or dissolved solids—conditions sludge—is compatible with other treatment.

Consult Dearborn, whatever your needs in water treatment. Serving industry since 1887.

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For information on Dearborn Polyamide Anti-Foams, write for Bulletin No. 5008. And for a complete description of Dearborn Industrial Water Treatment and Engineering Service, write for Bulletin No. 5000. The coupon is for your convenience.

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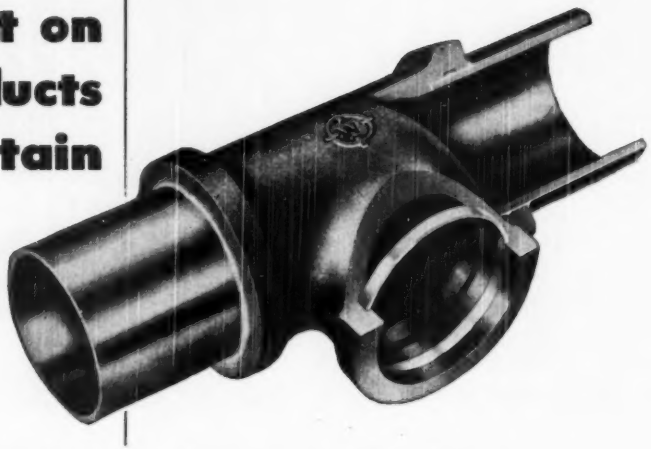
WATER TREATMENT AND SOFTENING COMPOUNDS • COMPLETE ENGINEERING SERVICE • NO-OX-ID RUST PREVENTIVES

DON'T BE SATISFIED WITH HALF-WAY MEASURES...

insist on Walseal® products and be certain



— the FACTORY INSERTED Ring insures FULL PENETRATION of the Silver Alloy . . . a perfect joint

Today, contractors . . . builders . . . architects are using brazed connections, in ever increasing numbers on their brass and copper pipe runs. However, they must be certain that the correct brazing alloy is used; that the joint has penetration of alloy up the shoulder of the fitting.

That's why more and more are turning to Silbraz® joints made with Walseal valves, fittings and flanges which assure the proper amount of alloy with no waste. They know that the finished joint not only will withstand hydrostatic pressure, but it will also withstand terrific impact and vibration – in fact, no correctly made Silbraz joint has ever been known to creep or pull apart under any pressure, shock, vibration or temperature which the pipe itself can withstand.

Furthermore, it is a relatively simple operation to make a Silbraz joint – no heavy scaffolding need be erected . . . just cut the pipe, flux, assemble, then braze, following the technique recommended by the Walworth Company. A silver brazing alloy – FACTORY INSERTED – in each port flows out when heated with the oxyacetylene torch, making a joint that is stronger than the pipe itself . . . a one-hand operation, with the mechanic out of the path of the deflected heat – at all times.

For full information about Silbraz joints made with Walseal products, write for Circular A-1.

WALWORTH

valves and fittings

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2 GREAT PIPE INSULATIONS

Unibestos No. 750 - to 750°F.
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Available in Cylinders or Half-rounds

UNIBESTOS®

. . . single-layer application saves money

When you can insulate a pipe efficiently with only one layer of covering, you save money. The range of thicknesses in which Unibestos Pipe Insulations are made permits the economies of single-layer application. Also a distinct saving in warehousing is made possible because fewer sizes of insulation are required in stock for maintenance work. But range of insulation thicknesses for single-layer application is only one of the many features of these 2 great pipe insulations—UNIBESTOS No. 750 and No. 1200. Write today for catalog giving complete information.*

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**New 8-page catalog (No. 48-1023) "UNARCO Insulations • Asbestos Packings • Gaskets • Textiles"*

A gauge for every need... *each the best of its kind*

Three basic groups of Marsh Gauges are shown here:

- The "Standard" group for the general run of gauge services.
- The "Quality" group for tougher service conditions.
- The "Mastergauge" group for the most extreme conditions.

While there is a considerable difference in the design and construction through these groups, the choice of a Marsh Gauge for a given application depends squarely upon the *service condition.*

This is because all Marsh Gauges — from lowest price to highest price — are high quality gauges. Each group or series contains the *best gauges of their kind.*

That is why you should use Marsh Gauges. Select the right Marsh Gauge and you use the most *economical* gauge for your requirement. We will help you select it.

Write for New Catalog.

MARSH INSTRUMENT CO.

Sales affiliate of JAS. P. MARSH CORP., DEPT. F, SKOKIE, ILLINOIS

MARSH GAUGES

THE STANDARD OF ACCURACY

New units in a large brewery's expansion program designed and built by The Kuljian Corporation

In the brewing industry, the last fifteen years have seen national production climb from 39,000,000 barrels annually to approximately 100,000,000.

Sharing in this growth, sturdy but outmoded plants have given way to new and expanded facilities. The brew house, power plant, and beer storage building depicted here are outstanding among the many important structures designed and built by Kuljian.

For more than a generation, Kuljian engineering and Kuljian construction methods have meant lower construction costs and lowered production costs in a wide range of processing and industrial fields.

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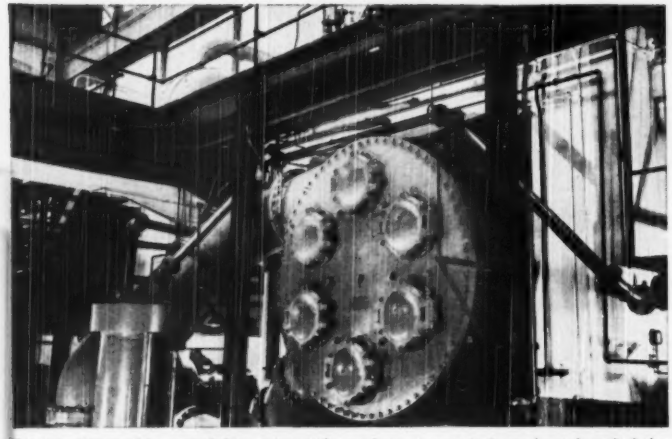
COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*



The best tubes possible are needed in a power station condenser to meet the heavy demands made during peak production times. Reduced efficiency and breakdowns are costly during troubled times.

Importance of Selecting Tubes for Long Service Vital Factor

Heavy military and civilian demands for condenser and heat exchanger tubes and piping are taxing the capacity of the mills.

In the future, an increased armament program and shortages of raw materials may possibly lead to mandatory rather than the voluntary form of allocation.

Expansion in the power, refining and chemical fields as well as in other processing industries will also make itself felt in reducing the amount of tubing available for short-term delivery. Engineers would therefore do well to take the long-term viewpoint when selecting alloys.

Study Life, Not Profit

Many engineers have been satisfied to go along with certain tube alloys knowing that there were better alloys on the market but reluctant to increase costs.

With the future indefinite, it would be far better to carry on experimental work with other alloys to determine the alloy best suited to carry them through a long period of heavy armament, if not war, with a minimum of replacement.

One power concern operating two plants has found through study that at one station only aluminum brass will give anywhere near satisfactory service. At the second plant, this alloy has proved its value but Admiralty is still used.

With the knowledge that deliveries of aluminum and high-copper alloys may be curtailed through priorities and dwindling supplies of raw materials, this concern ordered aluminum brass for both plants as their equipment so that tubes may be interchangeable.

Duplex Should Be Studied

In many processing fields, Duplex Tubing (one metal inside and another outside to combat dual corrosion problems) has been overlooked due to the price differential despite the longer service this tubing might give. The heat conductivity of Duplex Tubing is often higher than the ferrous tubing which it replaces. By using Duplex Tubing best suited for the individual job, longer life can often be obtained. At the same time, the increased efficiency of Duplex Tubing will enable higher production at a time when equipment and facilities in all fields will be taxed. Duplex Tubing Technical Bulletin #1950 is available on request.

Shortages Felt

During the last war, about the only alloy available without a high government priority was Admiralty tubing (70% copper, 29% zinc, 1% tin).

Shortages of nickel affected the supply of corrosion-resistant cupro nickel tubing, which was also in great demand by the government for naval vessels. The high copper content of aluminum brass and bronze as well as the shortage of aluminum curtailed the supply of these alloys.

Admiralty is a good alloy for hundreds of salt water applications but in cases involving high water velocities trouble from impingement corrosion may occur.

Laboratory Help Available

Bridgeport's corrosion laboratory has conducted many years of research into the corrosion problem. This information has been greatly augmented by the experiences of plant engineers and operators. For help in selecting alloys for heat exchangers and processing equipment, write to the nearest sales office or contact Bridgeport directly. Also available is "The Condenser Tube Manual" which covers the normal corrosion problems encountered by operating engineers as well as various types of alloys to meet varying demands.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • ESTABLISHED 1865

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal

(advertisement)

IS YOUR SLIPPAGE SHOWING?

..Important question for users of reciprocating pumps and air or hydraulic cylinder mechanisms

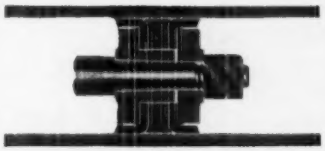
ILLUSTRATIONS at right show how Darcova Pumcups, in contrast to ordinary piston packing, virtually eliminate fluid slippage for the entire life of the packing. And, Pumcup life is many times that of ordinary packing.

By holding slippage to an absolute minimum, Pumcups permit reduced operating speeds, maintain high volumetric efficiency, prolong equipment life, save power, prevent wire-draw and uneven cylinder wear, and eliminate the need for frequent replacement shutdowns.

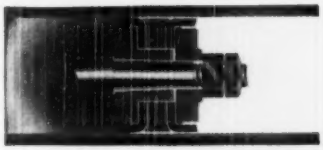
So if slippage is showing up in your operating and maintenance records . . . if replacement of packing is a too-frequent chore, that's your cue to switch to Darcova Pumcups.

For a free bulletin containing complete information, write, or use the coupon below.

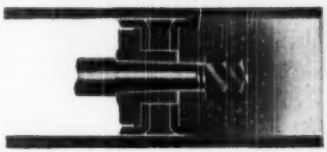
DIAGRAM OF PUMCUP ACTION GREATLY EXAGGERATED

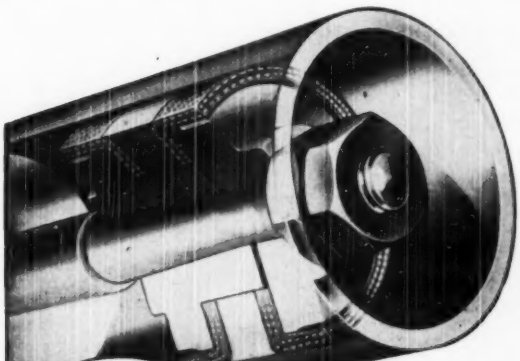


NORMAL: BOTH PUMCUPS RELAXED



UNDER PRESSURE: PUMCUPS SEAL AGAINST CYLINDER DESPITE WEAR, MINIMIZING SLIPPAGE





Darcova Pumcups replace ordinary packing in reciprocating pumps and also in air or hydraulic control mechanisms. They are precision built of an exclusive, exceptionally durable composition material available in many textures for use with almost any fluid under a wide range of pressures and temperatures. Standard sizes range from ⅛ to 42 inches in diameter.

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Please send me the free bulletin checked below:
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BIDDLE

Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

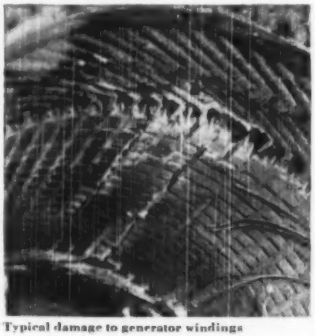
NUMBER 2 OF A SERIES

JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

REDUCE ELECTRICAL BREAKDOWNS IN YOUR PLANT with a Regular Schedule of INSULATION RESISTANCE TESTS

Irwin Robbins, Electrical Engineer, Factory Mutual Engineering Division writes in a recent article in PLANT ENGINEERING:

"The greatest single cause of electrical machinery breakdown is the failure of the insulation. Despite improvements in insulating materials in the past decade, insulation is still the most vulnerable part of an electrical machine . . ."



Typical damage to generator windings

It naturally follows that a regular program of checking the condition of electrical insulation pays off. Much can be saved in prevention of motor damage, wasted current, loss of production and *danger* to life and property.

For more than a half century the Megger Insulation Tester has been a highly effective means for testing any type of electrical equipment, whether a-c or d-c and irrespective of the voltage rating of the apparatus. It is direct-reading, easy to use and has its own source of power. It permits non-destructive tests which disclose incipient insulation weaknesses, rather than merely signaling insulation breakdown that has already occurred.

A series of periodic tests recorded on charts supplied with each Megger set assures you that the insulation of a machine is holding up . . . or warns you that insulation is becoming weaker and conditions should be investigated.

Most Trouble is Caused by Dirt or Moisture

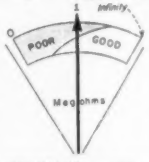
It is more economical to blow out dust, dry out coil windings, eliminate oil conditions, or even replace a motor or generator on off-hours *at the convenience* of the production and maintenance departments—than to have trouble strike unexpectedly and production interrupted indefinitely.

The story of electrical insulation resistance is told in our easy-to-read booklet entitled "For Practical Men." Most maintenance men, who have seen it, have requested extra copies for their associates. *Yours* will be mailed free of charge by simply requesting Bulletin 21P8-P.

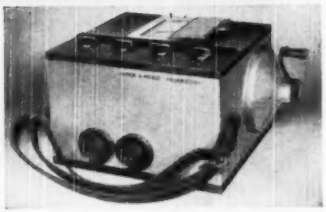
GETTING THE MOST FROM INSULATION RESISTANCE MEASUREMENTS . . .

Interpreting Results When Time and Test Voltage are Changed

Electrical men agree that the accepted method of determining whether insulation is healthy is by measuring its resistance. Megger Insulation Testers have long been the popular choice of men charged with the responsibility of electrical maintenance. These men recognize the importance of the proper analysis of the readings they obtain with their Megger instruments. The best thinking of men who know is available in Biddle literature on the subject. For our latest publication on electrical insulation resistance, "For Practical Men", just write to us at the address above and we will mail it at no obligation. Many who have already read this helpful booklet are requesting additional copies for their departments. Ask for Bulletin 21P8-P.



ONE MEGOHM per 1000 v is still a good practical guide



ONE INSTRUMENT FOR PRACTICALLY EVERY ELECTRICAL RESISTANCE MEASUREMENT

Bridge-Meg Measures a Fraction of an ohm up to 1000 megohms—Wheatstone Bridge Included —Varley Loop Optional

Wherever insulation resistance tests are made, wherever a Wheatstone bridge is needed, this instrument, with its hand-cranked, constant voltage generator is always ready for detecting, diagnosing, and locating electrical faults. Weighing only 15 pounds, this multi-purpose test set is an ideal field tool which quickly pays for itself over and over again.

The Wheatstone bridge is particularly useful in connection with measurements of all manner of coils, resistors and circuits.

The Varley Loop makes possible the location of faults on wires in telephone, telegraph, signal and electrical power systems in industrial plants and power companies.

Electrical modernization programs should include modern measurement and test methods. You should have complete information on this versatile Bridge-Meg Resistance Test Set.

Write for Bulletin 21-60-P.

We are constantly publishing new technical bulletins on Biddle Instruments. A complete list of our latest bulletins will be mailed you on request, so that you may check it to bring your files up to date.

(advertisement)

"For high dust collection efficiency **CONSIDER THESE FACTS!"**

95% to 99% REMOVAL

Your specific needs determine the exact percentage of fly ash removed by a Research Corporation Cottrell Precipitator.

LOW DRAFT LOSS

The pressure drop between inlet and outlet of the Cottrell is extremely low, averaging *only a few tenths of an inch of water.*

DURABILITY

Low velocities hold abrasion to a minimum.

ANY CAPACITY

Cottrell precipitators have been used successfully with both small boilers and the very large boilers developed in recent years.

OTHER APPLICATIONS

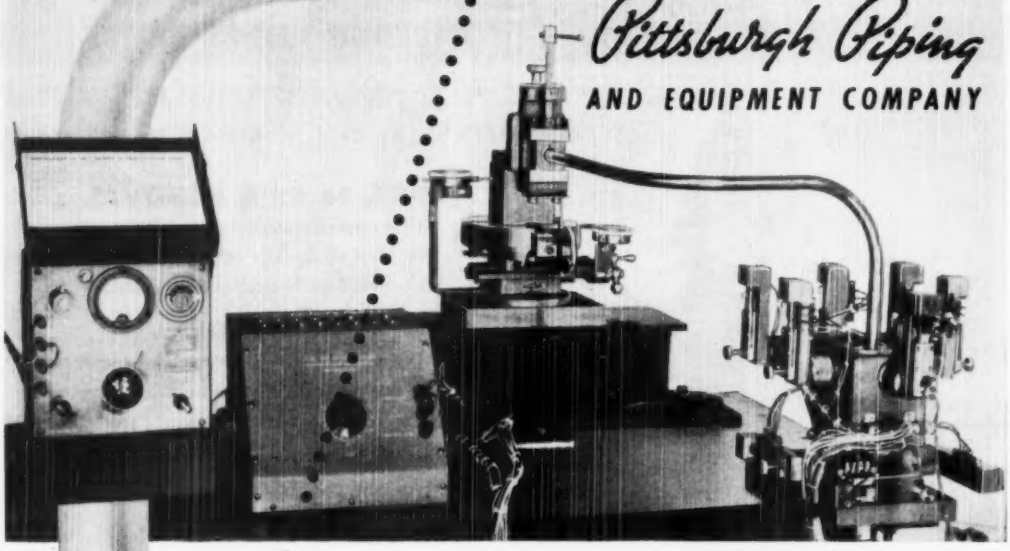
Cottrell precipitators have wide application in the recovery of other materials such as acid mist, blast furnace dust, sodium salts, fluid catalyst and valuable metals from smelters.

YOU GET all these important advantages PLUS Research Corporation's 38 years of experience in the field of electrical precipitation. Every Cottrell installation is individually engineered to do the most efficient job. For more facts about Research-installed Cottrells, send for Bulletin 500.

RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois

Model Testing at Pittsburgh Piping AND EQUIPMENT COMPANY



The Modern Method for Complete, Practical Pre-determination of Piping Flexibility

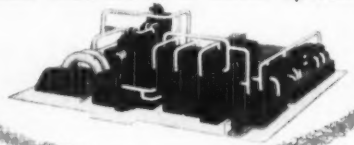
Model testing is one of the many technological advancements thoroughly investigated and proved by Pittsburgh Piping and Equipment Company before being made generally available. It provides complete advance knowledge of the reactions of any type, size, and system of power piping.

The testing apparatus shown above accurately measures and directly indicates the physical reactions of a section of pipe which exactly duplicates, in miniature, the planned layout. These measurements are projected to give precise information on the full size system as a check against theoretical calculations.

On complex piping layouts, model testing provides a complete analysis instead of theoretical approximation; it is a time and labor saver; and the possibility of mathematical error is minimized. Its use helps to avoid excessive stresses, reactions, and movements in the final system which could affect joints and thus cause leakage, or damage anchors and equipment connected to the pipe line.

Look to Pittsburgh Piping and Equipment Company for leadership in methods that assure greatest safety, highest efficiency, and longest service from high temperature, high pressure piping.

Model Testing makes possible the planning of high-pressure, high temperature piping systems with accurate advance knowledge of end reactions, stresses, and strains encountered in actual operation.



Pittsburgh Piping AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

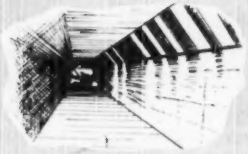
Woolworth Building, New York
Whitehead Building, Atlanta
Bank Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Heights State Bank Bldg., Houston

WHERE TO USE LUMNITE IN POWER PLANTS

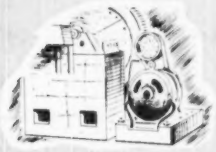
Steel Stack Linings

Ash Pit and Cinder Catcher Linings

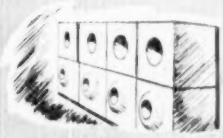
Coal Bunker Linings



Flue and Duct Linings



Overnight Structural Concrete

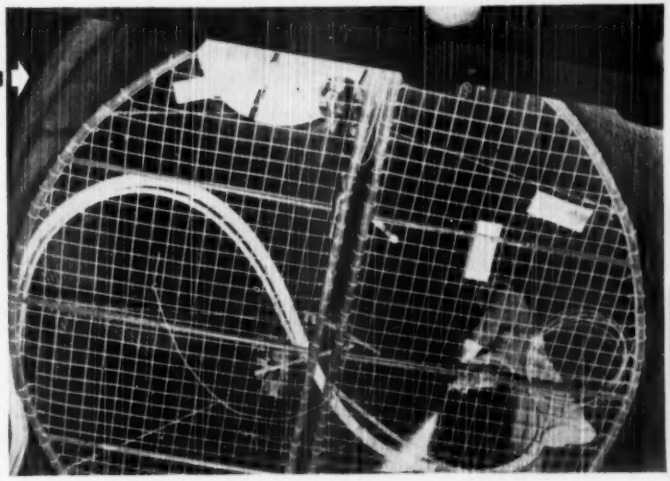


Castable Refractories

Factory-prepared mixtures of LUMNITE and selected aggregates. Mixed with water on the job, cast into place for door linings, arches, baffles, furnace walls. Special shapes can be cast in molds, ready within 24 hours. Castables to meet different temperature and insulation needs are made by manufacturers of Refractories, sold by their distributors.

Lining steel stacks with LUMNITE*

STOPS CORROSION
IMPROVES DRAFTS



Looking up through working platform in stack being lined with Lumnite refractory concrete. 2½" lining is being "shot" by concrete gun over reinforcing mesh attached to angle plates welded to steel shell.

CORROSION, the No. 1 enemy of steel stacks, won't harm this one. It's getting a protective lining of refractory concrete made with Lumnite calcium-aluminate cement. The Lumnite concrete will resist corrosive attacks of condensate and sulphurous gases. In the breechings, it will withstand the abrasive action of high-velocity gases and fly ash.

Drafts will be boosted, too. Lumnite cement, mixed with insulating aggregates, keeps gas temperatures high, cuts condensation inside the stack. And because the lining is smooth and jointless, there will be less loss of draft.

Easily Installed – Maintenance Reduced

Lumnite linings may be troweled into place or "shot" on by concrete gun as shown above. Because Lumnite linings are jointless, there are no small units to work loose. Thus less maintenance is required. When repairs are necessary, they can be made quickly and cheaply, for Lumnite reaches full service strength in 24 hours or less.

Depending on requirements, Lumnite provides high structural strength, high heat resistance and low thermal conductivity. Write for descriptive booklet on Lumnite for stacks, and other refractory, insulating, corrosion and heat-resistant concrete installations in power plants.

"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.

PL-32

Lumnite Division

UNIVERSAL ATLAS CEMENT COMPANY

UNITED STATES STEEL CORPORATION SUBSIDIARY

100 PARK AVENUE • NEW YORK 17, N.Y.

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network*

What do you want in a pump shaft?

Strength?
Resistance to corrosion? Hardness? Stiffness?

When you specify *Monel* for pump shafts, you get the combination of qualities needed to combat severe service conditions of wear, stress, vibration, corrosion, and heat. *Monel* insures against frequent, costly replacements; cuts maintenance overhead.

Remember...*Monel* has *all* these features:

- **High resistance to corrosion, corrosion-fatigue, and stress-accelerated corrosion.**
- **Exceptional hardness, which means less wear at bearings and journals.**
- **High resistance to fatigue caused by stress, vibration, and pulsation.**
- **Strength equal to that of steel.**
- **And if you need special properties, there is *"R" Monel* for high-speed production machining; *"K" Monel* that is heat-treatable to tensile strength higher than 150,000 psi; *"KR" Monel* that is both free-machining and heat-treatable.**

Monel and the other Inco Nickel Alloys can extend the life of your pumps, valves, gaskets, packing, tanks, heat exchangers and other equipment. For help in solving your power plant corrosion problems, write for "How to get longer service from your pumps." It is free.

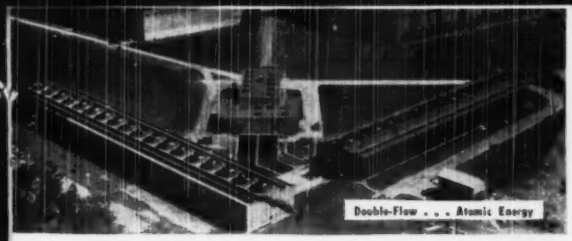
THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

MONEL
solved these difficult problems—

Case 1. In a large metropolitan power plant, the mild steel shaft of a huge circulating pump failed repeatedly because of corrosion-fatigue. Several other metals were tried without success. Then engineers called for "K" Monel. *The result was the world's largest high Nickel alloy pump shaft*—13'x9" dia.!

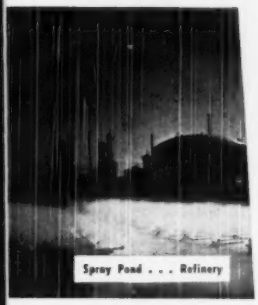
Case 2. A pump manufacturer had difficulty making long, thin shafts for multi-stage high pressure pumps. Stresses set up during machining caused the shafts to deform and fail in service. Heat-treatable *"K" Monel* was tried—and proved to be the solution to this problem, too.

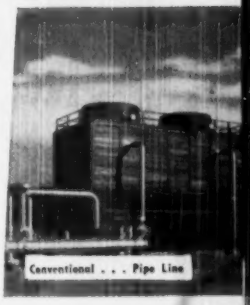
NICKEL INCO ALLOYS MONEL* • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL* • NICKEL • "L" NICKEL • "Z" NICKEL


Double-Flow . . . Atomic Energy

Double-Flow . . . Natural Gasoline

WHAT IS YOUR COOLING PROBLEM?


Spray Pond . . . Refinery

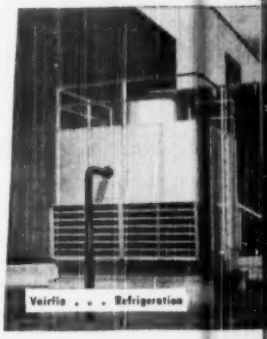

Conventional . . . Pipe Line

IS IT COST? Cooling towers or DriCoolers can have a low first cost with higher operating cost and vice versa. Or, you can get an economical combination of both. Marley application engineers have a complete line of units to select from and the "know-how" to help you make the best selection for your purpose.

DriCooler . . . Diesel Cooling

IS IT SPACE? Marley equipment may be installed indoors or outdoors. Units are available with large base area and low height to give light loading per square foot or with small base area and greater height to fit in small area.

IS IT TEMPERATURE? Usually, it is not economical to cool lower than a 5F approach to the wet bulb. However, in Marley cross-flow towers a quantity of water at wet bulb temperature may be obtained without added cost. For high level cooling, the DriCooler is applicable.


Vairflo . . . Refrigeration

IS IT LOCATION? Extreme temperatures, cold or hot, dust, wet bulb, altitude, brackish water, wind, storm conditions, or lack of proper water supply are problems that must be considered. Marley has a unit to fit any geographical condition.

Double-Flow . . . Power

IS IT APPEARANCE? Marley has a wide range of designs that will blend with any building architecture. Or even become a part of the building itself. Marley engineers can help your architect give you a good looking as well as efficient installation.

These are only a few of the problems you may face in the selection of a cooling tower or DriCooler. No matter what the problem, Marley Application Engineers have the answer to help you invest your dollars wisely and profitably.

DriCooler . . . Gas Cooling

MARLEY

Natural Draft . . . Air Conditioning

Write, Wire or Phone The Marley Company, Inc., Kansas City 15, Kansas.

P-10

Name _____ Title _____

Company _____

Address _____

City _____ Zone ____ State _____

☐ Please send "What's Your Cooling Tower IQ"

☐ Our Cooling Problem is _____

Aquatower . . . Air Conditioning

Finis

FOR THESE TROUBLEMAKERS IN PLANTS EQUIPPED WITH . . . . .

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE **REDUCING VALVE**

Here's why

IN THE USERS OWN WORDS . . . . .

(Note how users' statements check against the 10 benefit points listed below)

FROM A TIRE COMPANY

"We installed your '1000' reducing valve in our re-capping set-up about six years ago and to this date we have had **trouble-free** service. Periodically I check steam **pressure** and find it to be very **accurate.** I wouldn't hesitate a minute in recommending your Streamlined Reducing Valve."

FROM A BUTTON MANUFACTURER

We use the type '1000' valves on one of the **toughest operations** and they have operated 24 hours per day for the past 2½ years with **no maintenance.**"

FROM A GLASS MANUFACTURER

"We have one set of five pressure reducing valves (CASH STANDARD '1000') on a Hartford Empire ZU forehearth that have **operated accurately** and **trouble free** for five years **without** a dimes worth of **maintenance.**"

FROM A LAUNDRY

"We are well satisfied. We get **accurate pressure control under toughest working conditions — trouble-free service — cost-saving operation and practically zero in maintenance costs.**"

FROM A CHEMICAL MANUFACTURER

"We purchased our first CASH STANDARD Type '1000' Streamlined Valve six years ago and since then we have installed more than 200 of the '1000' valves ranging in size from ¼" to 1½". This is indicative of our complete satisfaction with the operation of the '1000'. A large number of the pressure reducing valves are **operating above your maximum specifications of temperature and pressure** with excellent results.

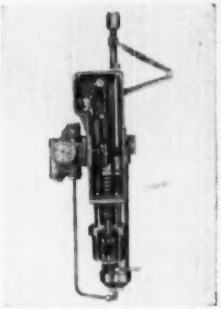
"The **elimination** of **steam leaks** and the **low maintenance** cost have been especially gratifying. The low initial cost, **low maintenance,** and **trouble-free** operation results in the **most economical** pressure reducing valve we have been able to purchase."

1. **Maximum capacity when needed most.**
2. **Accurate pressure control under toughest working conditions.**
3. **Trouble-free service.**
4. **Smooth operation.**
5. **Tight closure.**
6. **Speedier production results.**
7. **Elimination of failures.**
8. **Cost-saving operation.**
9. **No spoilage.**
10. **Practically zero in maintenance.**

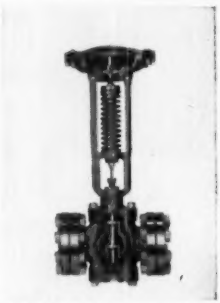
• WRITE FOR BULLETIN 962

BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them



Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

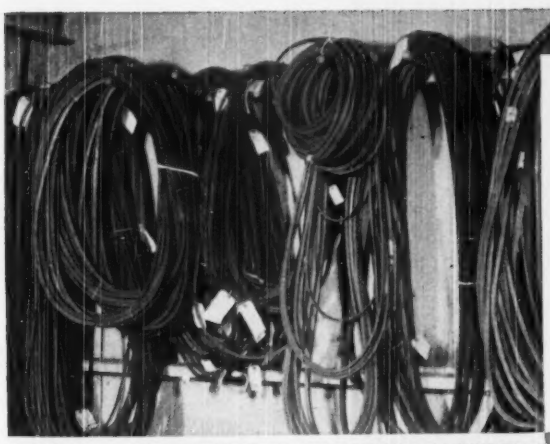


Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.

Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

CASH STANDARD CONTROLS . . . VALVES

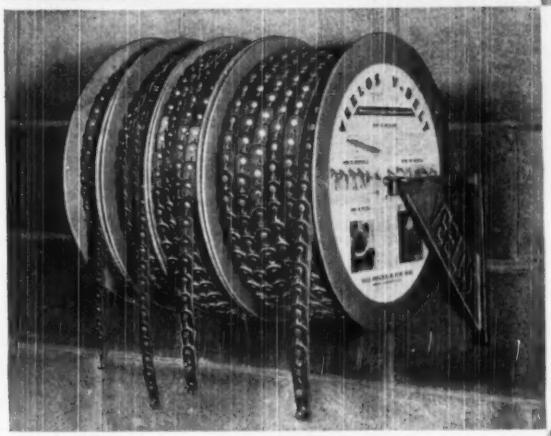
A. W. CASH COMPANY
DECATUR, ILLINOIS



when you use v-belts,
remember...

VEELOS CUTS COSTS ON V-BELT INVENTORIES

This large stock of endless v-belts is as unnecessary as it is costly and hard to keep under control. Switch to Veelos—the adjustable v-belt—and stop forever all this useless waste of time, space and money.



when you use v-belts,
remember...

VEELOS IN STOCK MEANS ANY SIZE BELT IS INSTANTLY AVAILABLE

Just four reels of Veelos can take care of as many as 316 sizes—*every* v-belt need in the O, A, B and C widths. No cluttered stockroom, no control problem, no replacement difficulties when you standardize on Veelos in the widths you require.

when you use v-belts,
remember...

VEELOS KEEPS MACHINES AT PEAK PRODUCTION

Veelos runs true for vibrationless, full power delivery. Veelos installs *quickly* and *easily*—and you never need to dismantle outboard bearings. Veelos can be simply adjusted to maintain uniform tension on all belts.

And, as a reminder...

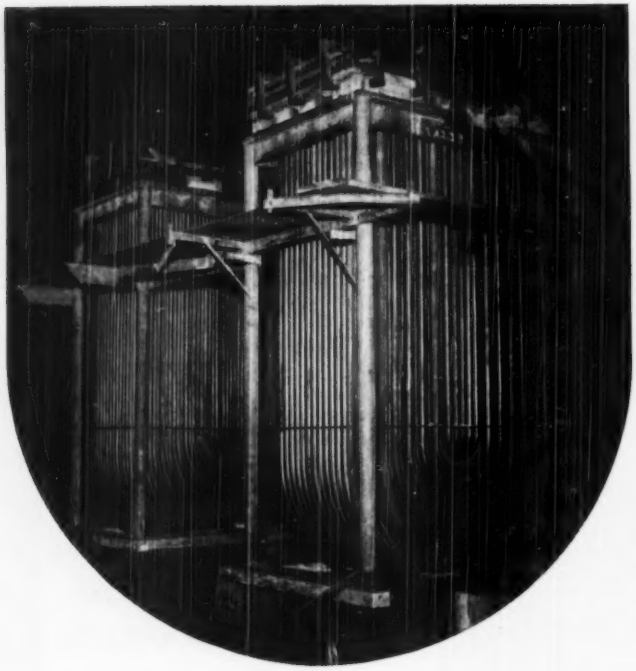
Write for your free copy of the Veelos Data Book and have all the facts on this adjustable v-belt at your fingertips.

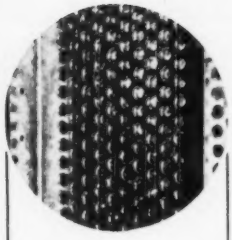
VEELOS
THE LINK
V-BELT

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. Veelos is known as VEELINK outside the United States.

MANHEIM MANUFACTURING & BELTING COMPANY, MANHEIM, PA.





New heat exchanger for BAKELITE

—another example of Lummus' ability to meet Specialized Heat Transfer Requirements

When the Bakelite Division of the Union Carbide & Carbon Corporation planned for their new Marietta plant, they gave their heat exchanger problems to Lummus.

Working closely with Bakelite engineers, Lummus designed a total of 36 U tube bundles. The first stage of the plant consisted of 8 bundles of carbon steel tubes and 4 bundles of 4-6 chrome alloy tubes. The second stage consisted of 24 chrome alloy bundles. The tubes were 1½" O.D. for the first stage and 2" O.D. for the second stage with all tube sheets 1" thick stainless clad steel. But, to assure absolutely gastight tube to tube sheet joints, Bakelite specified that all tube ends were to be roller expanded and welded into the tube sheets.

In meeting this specification, Lummus engineers faced a double problem of warpage and distortion of the tube sheets: (first) from rolling the tubes and (second) from high welding heat.

To fabricate the bundles, Lummus built the special assembly of racks and welding jigs shown above. A special test tank was built to pressure-test each bundle. The Lummus design was faithfully adhered to by top-grade welding and machining skill at the Lummus Honesdale (Pa.) plant where the heat exchangers were fabricated.

A typical job? No, but a typical example of the engineering skill and knowledge that goes into every Lummus-built job—knowledge that is available to you when you look to Lummus for your heat exchanger requirements.

THE LUMMUS COMPANY
Heat Exchanger Division
385 Madison Avenue, New York 17, N. Y.

LUMMUS

Atlanta • Boston • Chicago • Cleveland
Detroit • Ft. Worth • Houston • Minneapolis • Pittsburgh
Rochester • St. Louis • San Francisco • Wayne (Phila.)
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LOOK TO LUMMUS for Steam Surface Condensers • Evaporators • Feed Water Heaters • Boiler Blowdown Heat Exchangers Steam Jet Air Ejectors • Steam Jet Refrigeration • Barometric Condensers • Heat Exchangers • Process Condensers • Reboilers Steam Generators (Indirect Fired) • Fuel Oil Heaters • Lubricating Oil Coolers • Pipe Line Coolers • Jacket Water Coolers

These Tubes—

go in to stay—because the ZINC is in to stay!

CHASE ANTIMONIAL ADMIRALTY

(a patented alloy)

Antimony is an exceptionally efficient dezincification inhibitor—*when used in the right proportions.*

Admiralty with an antimonial content of less than .007% (the minimum set forth in Chase Patent No. 2,061,921) cannot be depended on to guard against dezincification under all conditions. For lasting service over a wide range of applications, .015% is the rock-bottom figure. Chase makes *doubly* sure you get this minimum percentage despite normal commerical variations—by using a nominal antimonial content of .035%.

Only Chase can make the *patented* Antimonial Admiralty offering this extra protection. Get the facts today.

Special stocks of
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THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

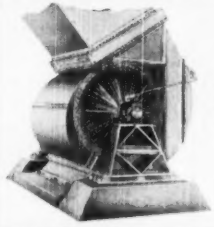
ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS DENVER† DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE
MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† ST. LOUIS SAN FRANCISCO SEATTLE† WATERBURY †Sales Offices Only

Experience really counts

When you're selecting draft fans

Putting *Air* to work . . . in power plants means Sturtevant mechanical draft equipment to specifying engineers. Down through the years they have learned that they can rely on Sturtevant's experience for satisfaction in mechanical draft.

Engineers know that this broad background of research, design and manufacturing skill will produce high efficiency fans . . . fans that thrive on high speeds, high temperatures, high pressures and large volumes. They know, too, that they can look to Sturtevant for equipment such as Vane Control® mechanisms for obtaining variable fan output at high efficiency, or the E-R (Erosion Resistant) Wheel, which will "take" the bombardment of thousands of tons of abrasive fly ash.



A Sturtevant Forced Draft Fan, showing the Vane Control mechanism.

For 90 years the name Sturtevant has meant dependable service to engineers in major power and industrial plants throughout the country. For full information on mechanical draft equipment, contact your local Sturtevant office, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

WESTINGHOUSE STURTEVANT MECHANICAL DRAFT equipment is found in most major power and industrial plants.

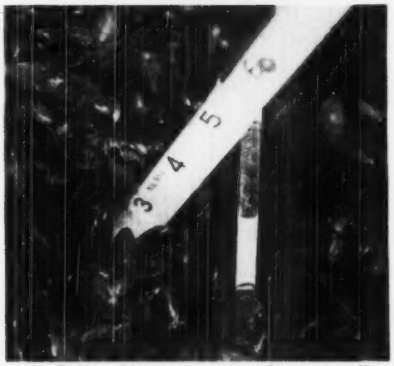
YOU CAN BE SURE...IF IT'S Westinghouse

J-80202

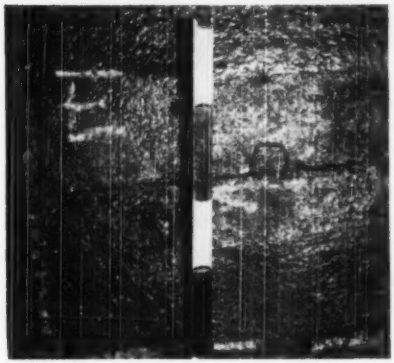
CHLORINATION BY WALLACE & TIERNAN

CONTROLS MARINE FOULING AT GENERATING STATION

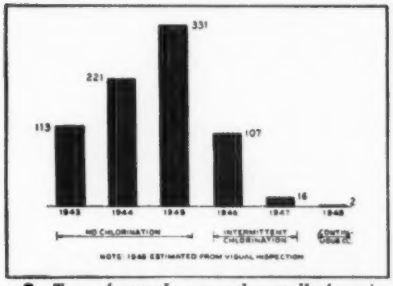
LOOK AT THESE RESULTS



1. Before chlorination — mussels cover wall to depth of 3".



2. After chlorination — note bare wall.



3. Tons of mussels removed annually from intake tunnel of generating station.

It all began when a New England generating station sent down a diver for a routine inspection of the large, concrete, circulating-water, intake tunnel located approximately 13 feet below the harbor's surface. The diver discovered this intake was lined with unusually heavy growths of common mussel (Mytilus), sea moss (Tubularia), and sea anemone (Metridia).

These were expensive visitors. First, mussel accumulation created poor vacuum as the mussels lodged in condenser tubes and aggravated slime and silt formation. Then, as the mass increased in quantity, it became necessary to clean the intake tunnel every year to remove up to a maximum of 331 tons of mussels — a time consuming process that cost thousands of dollars in labor and equipment outage.

To combat these conditions a long and thorough study was made of marine fouling. As a result it was decided to use intermittent chlorination applied by Wallace & Tiernan Chlorinators. First to fall under this attack were the sea moss and the sea anemone. The tougher mussels however, still remained as numerous as ever.

In an all out effort to get rid of these trouble makers, continuous chlorination at heavier residuals was started. This treatment turned the trick and the mussels were reduced to such a low level that yearly cleaning has not been required.

These results saved the New England company thousands of dollars annually by eliminating intake tunnel cleaning, reducing condenser outages, and producing a higher vacuum with a resultant saving in fuel.

Perhaps your problem is one of slime or fouling due to some other marine organism. In any event, if biological fouling is costing you money through lowered cooling water efficiency it's a safe bet that chlorination can help.

See your nearest Wallace & Tiernan Representative now for all the details.

CD-34

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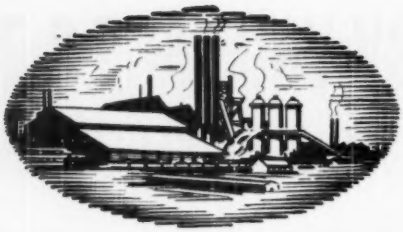
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
Belleville 9, New Jersey • Represented in Principal Cities



1900 ★ THE MIRACLE OF AMERICA ★ 1950

Freedom and Progress

It's no stretch of the imagination, rather, robust realism to call our past half century a Miracle—U. S. A.

America has set an amazing record of progress in 50 years—but a moment in the history of civilization. A record unequalled by any other political or economic system.

Merely by broad brush strokes, we can all visualize this miracle. Remember the crystal set, the hand-cranked car, the biplane? A far cry from our FM radio, television, hydro-matic drive and supersonic planes.

And here's another phase of the miracle that went hand-in-hand with these and the myriad of intertwined technological advances—ranging from the radio telephone and Bakelite to the X-ray tube and teletype . . . and to atomic energy and its untold potentialities.

- Since 1900 we have increased our supply of machine power 4½ times.
- Since 1900 we have more than doubled the output each of us produces for every hour we work.
- Since 1900 we have increased our annual income from less than $2400 per household to about $4000 (in dollars of the same purchasing power), yet . . .
- Since 1900 we have cut 18 hours from our average work week—equivalent to two present average workdays.

How did we do it? The basic cause for this composite miracle has been the release of human energy through FREEDOM, COMPETITION and OPPORTUNITY. And one of the most important results is the fact that more people are able to enjoy the products of this free energy than in any other system the world has ever known.

THIS IS THE MIRACLE OF AMERICA . . . it's only beginning to unfold.

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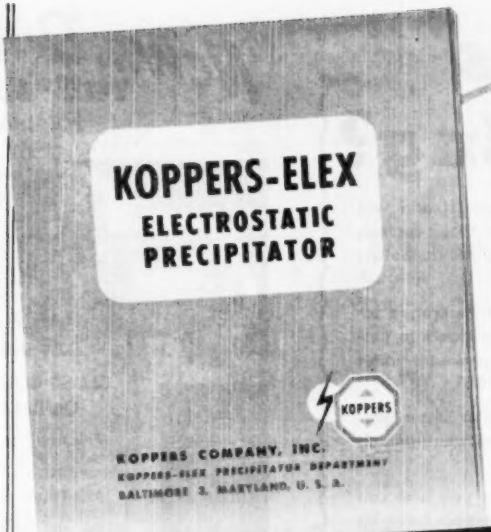

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There is a representative near you who can give engineering help on the proper hook-up for your particular plant.

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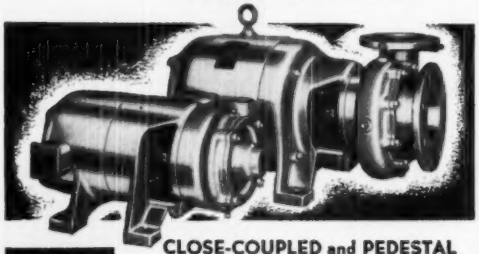

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Open as well as enclosed type impeller for slurry and other services.

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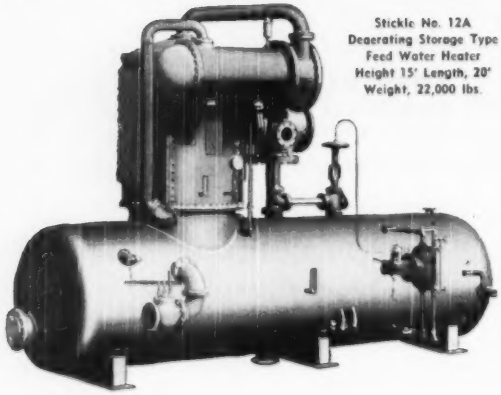

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It pays to preheat boiler feed-water with Stickle Open Coil Heaters—pays to the tune of a savings in fuel of 10-15% or more! Stickle three-section, circular trays help turn the trick . . . provide *extra* surface to heat more water to higher temperature in less height than any other heaters on the market. Stickle Open Coil construction brings feed-water into direct contact with the steam—immediately transmits heat from steam to water.

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*Stickle Open Coil Heaters are available in a wide variety of sizes — in capacities ranging from 3,000 to 250,000 lbs.

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That is why Power Piping Division is so often selected to do critical jobs. It has the facilities, the staffs, the shops, the equipment, the engineering and designing knowledge to handle any size piping job quickly, authoritatively, economically. And the results speak for themselves over the years.

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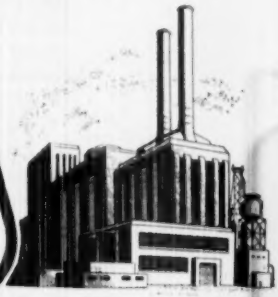

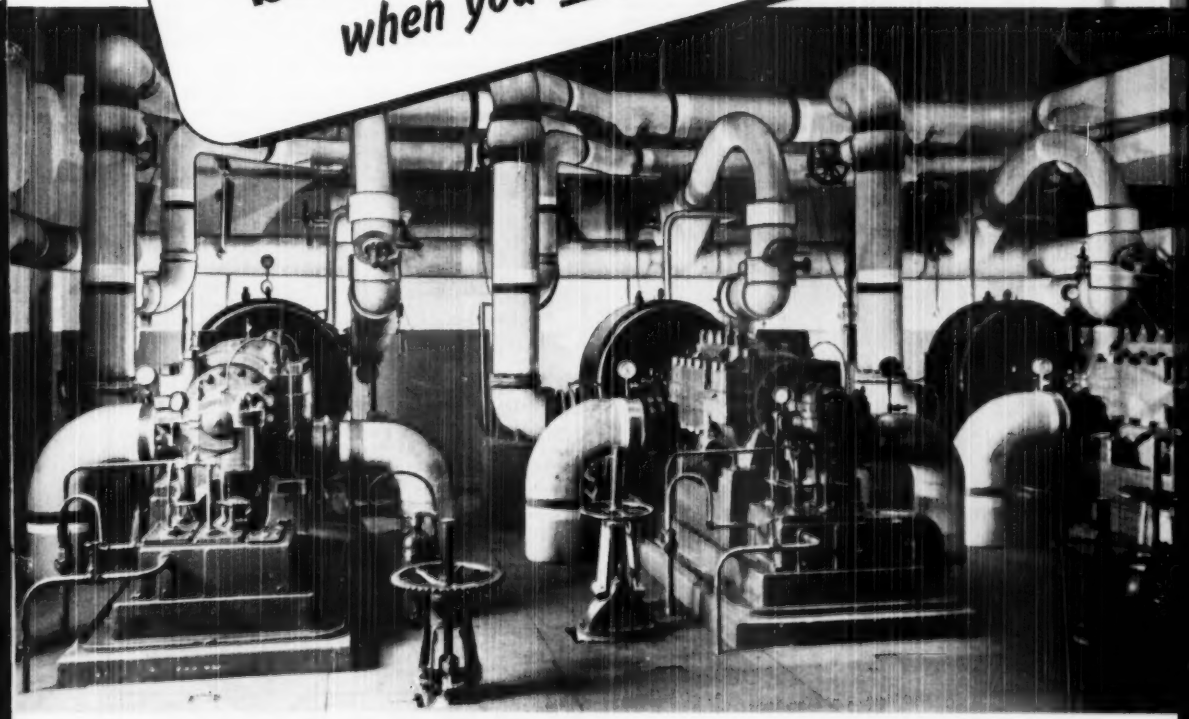

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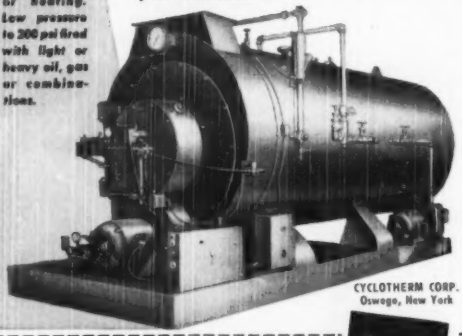
SIZES *available to fit your steam or water load for processing or heating. Low pressure to 200 psi fired with light or heavy oil, gas or combinations.*



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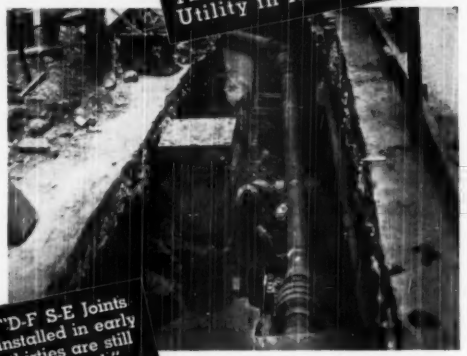

"D-F S-E Joints installed in early thirties are still on the job"

Back in the early thirties the now-famous Badger Directed-Flexing principle was added to the Self-Equalizing construction. The principle underlying the idea (see illustration below) looked sound to the Utility Engineers and several joints were ordered and installed in their central heating distribution system. Badger D-F S-E Joints are still on the job.

With this Utility, as with hundreds of others, Badger Directed-Flexing Self-Equalizing Expansion Joints are famous for performance. Reason? *Exclusive* construction features which guarantee longer life without maintenance. So be wise, figure in terms of *costs* and specify Badger Joints. Send for your copy of new 24-page catalog.

Badger Joints flex like this . . .
All-curve flexing guarantees longer life
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EXCLUSIVE construction of Badger Joints eliminates localized flexing stresses that cause breakdowns. Directed Flexing Equalizing Rings control and contain movement to *all-curve* pattern — distribute stresses to all parts of flexing member.
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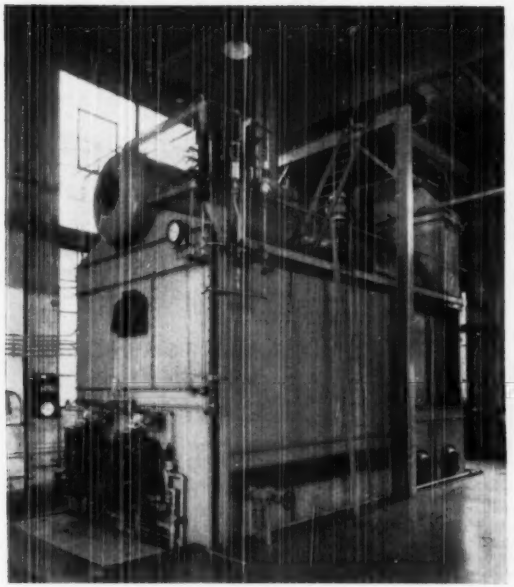
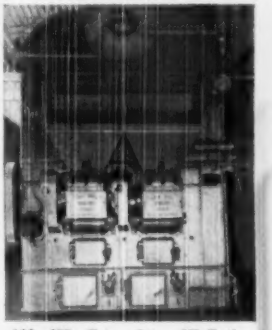
A LOW HEADROOM BOILER

That can take it

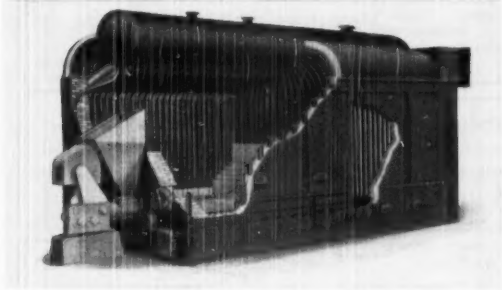


250 HP Erie City VL-Boiler oil fired at a western New York dry cleaning plant.

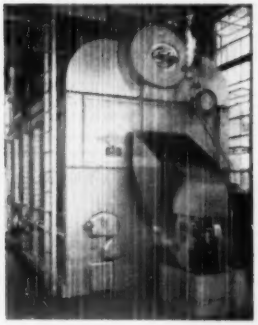
THIS compact, low headroom 2 drum water tube boiler features extra large water and steam capacity. Side wall water cooling reduces refractory maintenance to the vanishing point even at maximum ratings. As illustrated here the VL is well adapted to all firing methods. The VL's all steel casing and trim appearance makes any boiler room a showroom. It is recommended for sizes to 750 HP and is furnished as a completely shop assembled unit in sizes to 300 HP and larger depending upon railroad clearances.



160 HP Erie City VL-Boiler fired by Erie City Spreader Stoker in an Ohio automobile manufacturing plant.



Outstanding of many VL features is the ring-flow circulation in each side wall element. A downcomer tube for each pair of radiant (riser) tubes in the side wall with auxiliary front wall downcomers assure an ample supply of clean circulating water in the walls at all times. Tile between riser and downcomer tubes assures rapid and unrestricted circulation.



200 HP Erie City VL-Boiler fired by Erie City Underfeed Stoker in a western paper products plant.

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***write for* BULLETIN SB24B**

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CMH Expansion Joints are preferred by so many piping engineers

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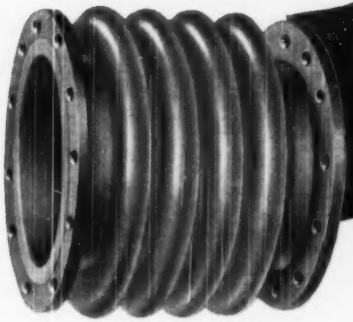
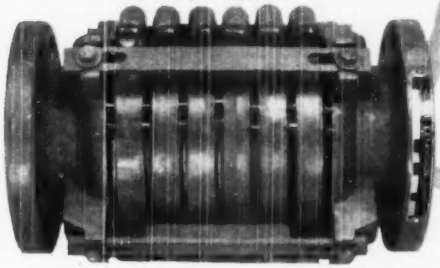
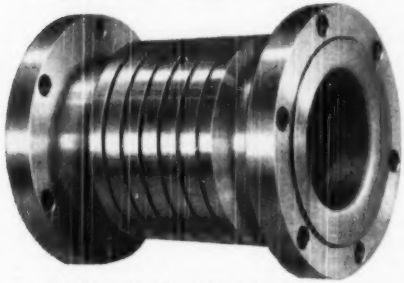
- ✓ Weight Saving
- ✓ Streamlined Flow
- ✓ Lower Overall Cost
- ✓ Ease of Installation
- ✓ Trouble Free Operation
- ✓ Freedom from Maintenance



CMH Free-Flexing Expansion Joints for pressures to 30 psi; stainless steel or copper; flanges or welding ends; standard sizes to 30" I.D.; larger sizes available for special applications.



CMH Controlled Flexing Expansion Joints for pressures to 300 psi; stainless steel or copper; flanges or welding ends; sizes to 30" I.D.



CMH Flexoniflex Expansion Joints with integral control rings for pressures to 1500 psi; stainless steel and other alloys; standard sizes 3/8" through 6" I.D.; larger sizes also available.

THE PROBLEMS of pipe motion control are reduced to a minimum when you use CMH corrugated type expansion joints. Scientifically formed by advanced methods, they represent the modern, cost-saving, trouble-saving way to control axial, lateral or radial motion in piping or to correct for misalignment.

For new installations or for replacement of obsolete equipment, specify CMH expansion joints. Complete data is given in CMH'S Expansion Joint Design Guide. Write for a copy . . . it's the first step towards eliminating the headaches that are so often a part of pipe-line motion control.

Flexon identifies CMH products that have served industry for over 48 years.

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POWER PLANT PERSONNEL

An east coast utility now constructing a new high-pressure pulverized fuel generating station, the first two units of which will have a capacity of 132,000 K.W., will accept applications for employment from qualified persons for the following positions. These positions will be available in the fall.

CHIEF OPERATOR

Responsible for the operation of two steam-electric generating units from a fully centralized control room. Will be required to direct other operators in the performance of their duties and operate the plant from the control room. Must have previous experience as an operator of pulverized fuel boilers, hydrogen-cooled turbine generators, high voltage switchboards, condensers, boiler feed pumps and all related auxiliaries.

ASSISTANT CHIEF OPERATOR

Will be required to assist the Chief Operator in directing the operation of, and operating from the centralized control room all equipment such as pulverized fuel boilers, hydrogen-cooled turbine generators, switchboards, condensers, boiler feed pumps and all related auxiliaries.

MAINTENANCE FOREMAN

Must have good background of experience and be able to direct the maintenance of all power plant equipment, such as boilers, turbines, pulverizers, pumps, fans, air compressors, coal handling, machine shop, etc. Must have good mechanical ability and be able to take full charge of maintenance crew under the direction of the master mechanic. This job to be filled immediately.

Job is centrally located near excellent residential community, good working conditions, forty-hour week (paid vacations, insurance, sick pay and retirement plan). All personnel selected for employment will be given complete job training at full pay to familiarize them with this particular installation before assuming their regular duties.

Include complete resume of experience and qualifications in first letter, together with recent photograph. All applications will be treated confidentially.

P-6897, POWER

330 W. 42nd St., New York 18, N. Y.

SALES ENGINEER

Now it is possible to PREVENT formations and accumulations of Slag and Fireside deposits on boilers and furnaces. Our new System causes the complete combustion of the Combustibles in the furnace area. The Ash is deposited in the Ash Zone instead of entering the tube bank or building up, on the walls. Smoke Control is an accomplished fact. This System was developed through long research by a Nationally known, well established Manufacturer.

The importance of this new development to Industry offers an exceptional opportunity for large repeat business to Sales Engineers who have Combustion experience in the Industrial and Utility Power Plant fields.

Salary, Expenses and Commissions. Agents also considered.

State experience and qualifications in reply.

SW-6533, POWER

520 N. Michigan Ave., Chicago 11, Ill.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** :EQUIPMENT :USED OR RESALE

UNDISPLAYED

$1.20 per line, minimum 4 lines. To figure advance payment count 5 average words as a line.

INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of above rate, payable in advance.

Box Numbers—Care of publication New York, Chicago or San Francisco offices count as one additional line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

—RATES—

DISPLAYED

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $10.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

New Ads Received by Oct. 5th at the New York office, 330 W. 42nd St., New York 18, N. Y., will appear in the Nov. Issue subject to limitations of space available.

Engineers — Executives — Technical Men

Salaried Positions, $4,000 to $30,000

This Confidential service for men who desire a new connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details.

TOMSETT ASSOCIATES

1205-2 Berger Bldg., Pittsburgh 19, Pa.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED: MAINTENANCE engineer to analyze and rectify excessive machine and plant repairs. Steady employment in Engineering Department of company operating several plants. Give experience and qualifications; also salary expected. P-7388, Power.

POWER ENGINEER—Electrical or Mechanical Engineering graduate with a minimum of fifteen years' experience, of which at least five years must have been in responsible charge of the design, operation and maintenance of industrial steam and electrical generation and air conditioning equipment, industrial electrical control facilities and instrumentation. Position requires a man who is well grounded technically, cost conscious, experienced in industrial relations, capable of dealing effectively and harmoniously with associates, and capable of immediately assuming responsibility. P 7704, Power.

WANTED: ASSISTANT Electrical Engineer for a large industrial plant in Maryland. Applicant must be under 30 years of age, possess the degree of B.S. in Electrical Engineering from an accredited college, and have had at least three to five years' experience in industrial plant electrical construction and maintenance work. Salary open. P 7651, Power.

ELECTRICAL POWER Plant Designer-Draftsmen wanted. Experience in electrical control design and planning desirable. Location South Atlantic States. P 7487, Power.

SALES ENGINEER compressors and centrifugal pumps for heavy industrial and power plant service, New York area. M.E. graduate preferred. Salary commensurate with ability and experience. Submit complete record and photo with reply. P 7682, Power.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (40 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 270 Dun Bldg., Buffalo 2, N. Y.

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

POSITIONS WANTED

POWER HOUSE Supt. or Asst.—Twenty years operation, maintenance, operator training and construction in power and chemical plants. 3 years college. Experienced on high pressure piping, boilers, turbines, pumps, compressors, pulverizers, filtration plants and water treatment. Excellent personnel handling record. Will take full charge and responsibility of operation construction and/or maintenance, midwest preferred, available at once. PW-7762, Power.

SALES MANAGER AVAILABLE

Experienced in direction of salesmen, sales agents, and distributors. Selling in power maintenance and erection field. Responsible for sales promotion, quotations, advertising.

Contacts with top executive oil and power companies, construction engineers and contracting firms, shipping and ship building companies.

Knowledge Government contracts, agencies, Navy, Army, Marine.

Technical background includes: design operation and erection stationery and large utility, marine.

For complete information write:

PW-7622, POWER

330 W. 42nd St., New York 18, N. Y.

REPRESENTATION WANTED
METROPOLITAN NEW YORK

Well established Manufacturers' Agents expanding, are interested in equipment for Oil Refinery, Chemical, Industrial, Water Works, Power & Sewage Plants.

RA-7574, POWER

330 W. 42 St., New York 18, N. Y.

POSITIONS WANTED

CHIEF ENGINEER ex-Navy, 49, N. J. Gold seal. Will take full responsibility proper operation and maintenance H. P. steam plant 160,000 lb. hr. fuel oil-pulverizers, turbines, refrigeration, etc. Accept less responsibility in suitable plant. Present salary $5,500. PW-6982, Power.

POWER PLANT Operator, age 29 with eight years experience in modern power plant operation and maintenance, also some refrigeration. Technical school graduate. PW-7433, Power.

MECHANICAL ENGINEER — 39, B.S. degree, A.S.M.E., 13 yrs. experience in power field, including steam electric station, electric welding, marine operation and maintenance. Desire position in stationary plant. PW 7714, Power.

POWER ENGINEER—Twenty-five years experience, operation and maintenance of modern power plants, electrical equipment, refrigeration, air conditioning and water filtration plants. Fifteen years high pressure plants, some construction experience, desire supervisory-engineer position with a utility, industrial plant or municipality. Registered engineer, gold seal licensed power plant operator. Will relocate or travel. PW 6662, Power.

PART TIME WORK WANTED

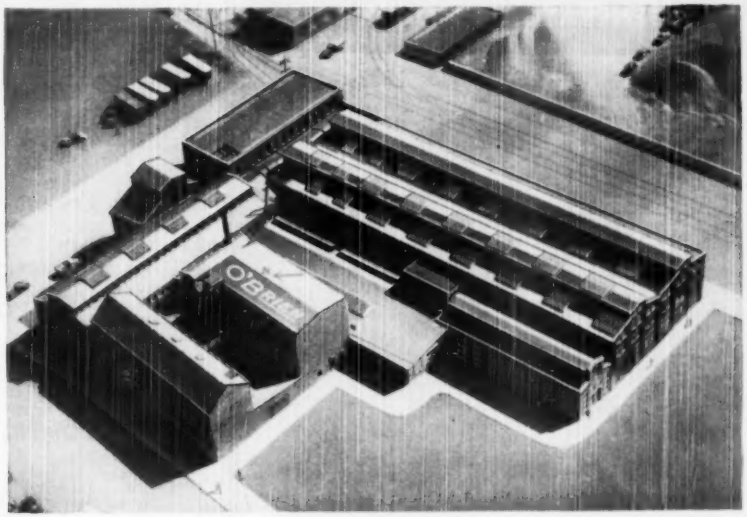
MODELMAKER — MODELS made for plant, process planning, construction progress, employee training, public education and display. PTWW 7524, Power.

SELLING OPPORTUNITIES WANTED

A WELL established incorporated company desires to represent a manufacturer of high grade power plant equipment in Northern Ohio territory. Address RA-7566, Power.

Equipment Wanted Advertising—page 301

Q U A L I T Y



I N T E G R I T Y

NEW OFFICE, SHOWROOM, SHOPS AND WAREHOUSE
1545 N. DELAWARE AVE., PHILADELPHIA, PA.

ELECTRIC MOTORS

3 PHASE — 60 CYCLE

Q.	HP	Make	Type	Volts	Speed
1	1200	Cr. Wh.	Sl. Rg.	2300	257
1	1000	West.	CW	2300	450
2	600	West.	Syn.	440	257
1	600	G.E.	IM	440/2300	600
1	450	G.E.	TS(Syn)	440	360
1	350	West.	CW	440	600
1	350	G.E.	Syn.	440	900
1	315	G.E.	Syn.	2200	720
1	250	West.	CS	2200 (25 cyc)	375
1	250	West.	CS	2300	1200
1	200	West.	MW	440	600
2	200	West.	CW	440	600
2	180	G.E.	Syn.	4000	257
1	150	Al. Ch.	SC	220	1800
1	150	Ideal	Syn.	220	1200
1	150	El. Mch.	Syn.	220	900
1	150	G.E.	KT-558	440	900
1	125	Cent.	SC	440	1800
2	100	West.	CS	220	1800
1	100	Cr. Wh.	Syn.	220	1800
1	100	Cent.	SC	220	1200
1	100	G.E.	IM	440	600
2	75	Cent.	SC	440	1200
1	75	West.	CW	440	1200
1	60	Ideal	SC	220	1200
1	60	West.	CW	440	600
2	50	Cent.	SC	220	1200
1	100	West.	SK183	230V. D.C.	400/1200
1	50	Cr. Wh.	CMC	230V. D.C.	300/1200

MOTOR GENERATOR SETS

1—1000KW GE MPC ATI 550v. 3/60/2300
1— 500KW GE MPC ATI 250v. 3/60/2300/720 rpm
2—400KW ELLIOTT COMPANY, 250 volt, 1200 rpm, 2300 volt, 60 cycle A.C. and D.C. Controls—New 1939
1—200KW G.E. 250 volt, 3/60/2300, 1200 rpm Synchronous
1—100KW G.E. 125 volt, 3/60/220/1200 rpm Synchronous
1— 50KW G.E. 250 volt, 3/60/240/1200 rpm
1— 50KW G.E. 125 volt, 3/60/220/1200 rpm
1— 40KW Ideal, 125 volt, 3/60/220/1200 rpm

AIR COMPRESSORS

1—3000CFM Sullivan Angle Compound 100 psi, 500 HP Syn. M.D. 3/60/2300
1—1050CFM Worthington, 18x11x14 100 psi, 257 RPM, Belted
1—1050CFM Ingersoll-Rand ES-1, 17½x13, 50 psi, 275 RPM, V-belt
1—884CFM Chicago Type YCM, 125 Lb., 125 HP Syn. M.D. 3/60/440 Automatic Control
1—734CFM Sullivan Angle Class W13, Single Stage 13x13x8, 60 Lb., 200 RPM, v-belt, 100 HP
2—528 CFM Chicago NSB, 100 Lb., 285 RPM, V-belt, 14x12
2—368CFM Ingersoll ER-1, 285 RPM, 100 psi., 50 HP direct gear, M.D., 3/60/220
1—294 CFM Ingersoll ES-1, 10x11 Direct Syn., M.D., 3/60/440, 100 psi., automatic control
1—229CFM NEW Chicago PB 4 Air Cooled, 870 RPM, 125 Lb., V-belted, 50 HP, M.D.
1—245CFM IR-10x10 ER-1, 125 Lb.
1—215CFM Penna. 3A—10x8, 50 Lb.
1—211CFM NEW Chicago 9x9 T-B Horizontal 100 psi, V-belt
2—173CFM Ingersoll ER-1, 9x8, 300 RPM, 100 Lb., V-belt
3—120 CFM I-R—8x6 ER-1, 55 Lb.
1—92CFM I-R—7x6, ER-1, 100 Lb.
1—67CFM Chicago NSB—6x6—150 Lb.

DIESEL GENERATORS

200KW Fairbanks Morse, 250 v., D.C. 720 rpm 8 cylinder, 4 cycle, Complete—1940
200KW G.E.-Fairbanks Morse, 720 rpm, 3/60/220/440—8 cyl., 4 cycle—1940
156KVA Cummins LI 400 3/60/440/900 rpm—Radiator—Sw. Bd.
113KVA Waukesha Portable, 3/60/440, 1200 rpm 1944
100KVA Cooper Bessemer 8 cylinder, 900 rpm, 3/60/220
56KVA G.E.-Climax Gasoline Portable, 3/60/220/1200 rpm
40KVA NEW Chrysler 3/60/220—2 units
30KW Buda, 3/60/220/1200 rpm
20KW Le Roi Gasoline—1/60/110-220 volt

TURBO-GENERATORS

Non-Condensing

1—625KW West. 3/60/2300/3600 RPM, 125 Lb. psi, 6 Lb. B.P.
1—400KW West. 3/60/480, 150 psi., 10 Lb. B.P.
1—300KW Elliott (New 1941) 250 Volt D.C., 150 Lb. I.S.P., 20 Lb. B.P.
1—300KW G.E. 3/60/2300/100 p.s.i. 0-15 Lb. B.P.
1—300KW G.E. 3/60/2300/3600 RPM, 175 psi, 5 Lb. B.P.
1—160KW West. 3/60/220/3600 RPM, 125 Lb. psi., 10 Lb. B.P.
1—160KW Ridgeway 4 Valve Steam Engine Generator, 3/60/220
1—150KW NEW West. 250 Volt D.C. 225 Psi., 25 B.P.
1—100KW NEW 3/60/220 150/200 psi. 0/30 Lb. B.P.
1—50KW West. 3/60/220/1800 RPM, 150 psi. 10 Lb. B.P.
1—35KW G.E. 125 volt D.C., 3600 RPM

"Everything from a Pulley to a Powerhouse"

SINCE 1915

THE O'BRIEN MACHINERY CO.

T. M. REGISTERED U. S. PATENT OFFICE

Cable Address: OBRIEN PHILA.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

1545 North Delaware Avenue • Philadelphia 25, Pa., USA — Bell Phone Garfield 6-1150

AFFILIATED WITH
SOC EXPANSÃO INDUSTRIAL SUL AMERICANA LTDA
RIO DE JANEIRO—BRASIL

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVE. CLEVELAND 14, OHIO

WRITE FOR STOCK LIST No. 1622

VARIABLE VOLTAGE DRIVES

40 HP Reliance Variable Voltage Drives, each Consisting of:
1—40 KW 250 Volt Induction M-G Set with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 385T, 230 Volt, DC Motor.
With full magnetic control providing log forward, log reverse, run, fast, slow, and stop, and motor operated field rheostat.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	HP	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-5261
2	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	820	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-464C
2	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	550	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	550	440	G.E.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
2	40	865	2200	Al.Ch.	ARY-223C
1	40	560	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	860	440	West.	HF-12A
1	50	570	880	G.E.	MT-352
5	52‡	550	220	G.E.	IQC-5013***
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546
1	60	345	550	West.	CW-5538
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-540
1	175	505	550	West.	CW-1002
2	200	600	550*	G.E.	IM-17
1	200	495	2200	G.E.	IM-17A
2	250	600	2300†	G.E.	IM-17
2	300	900	140	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	600	1770	440	G.E.	IM-E15C
1	650**	360	440	G.E.	MT-442Y
1	700	735	4000‡‡	West.	CW

220 volt motors can be reconnected for 440 volts.
‡Intermittent rating. *** 2 phase.
** New. ‡‡ 25 cycle.
†Also 440 or 550 volts. *Also 440 or 2300 volts

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding & Direct Connected Exciter.

Qn.	KVA	RPM	Make	Volts
4	18.7	1800	Columbia	240/120
5	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D. C. MOTORS

Qn.	HP	Speed	Make	Type
10	3	850	Reliance	Y-23T
25	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-65
3	7½	850	G.E.	CD-75
10	10‡‡	1750	Kimble	BA-324
5	10**	1150	Al.Ch.	EB-80
10	10	850	West.	SK-83
10	13½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
5	15	825	West.	SK-90
1	20	1750	L.A.	ONA-LS61
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1160	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-140
1	50	690	G.E.	RC-16
1	60	1750/1310	West.	SK-143
1	150	700	Al.Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D. C. MOTORS

Qn.	HP	Speed	Make	Type
6	5/7½	600/1800	G.E.	Ka-30
1	10	400/1600	Reliance	T-92T
2	10/15	600/2400	Reliance	T-92T
10	12½	250/340	West.	SK-130
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	KF-11
1	20/25	100/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
2	25/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-143
1	30/40**	400/1600	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	600/1200	Reliance	F-4611
1	75	500/1500	Cr.Wh.	CCM
1	75	375/750	Cr.Wh.	CMC-125M
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.Ch.	
1	100	320/960	West.	SK-200
1	125	450/1000	West.	SK-140
1	175	230/500	West.	SK-220
2	375	350/500	G.E.	MPC

**New.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
1	.5	3480	220	G.E.	K-225
2	.5	1750	440	L.A.	JA-254
10	.5	1750	440	G.E.	K-254
5	7.5	1740	440	G.E.	K-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-EXP
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1760	220	G.E.	K-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1	40	3565	440	G.E.	KF-4058

Splashproof, Ball Bearing

Qn.	HP	RPM	Volts	Make	Type
23	.5	1750	440	L.A.	FS-254
1	.5	1735	220	G.E.	K-254
1	.5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
2	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6335
1	200	885	440	L.A.	FS-1378

Open Type Motors

Qn.	HP	Speed	Volts	Make	Type
1	15	3485	220	Reliance	AA-53247
5	15**	1735	440	Century	8C326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	C8-326
5	20**	1750	440	Wagner	RP1-364
1	20	1750	220	West.	C8-W364
1	20	1200	220	G.E.	KF-512
2	20	1160	440	West.	C8-464C
2	20	900	220	G.E.	FTR-522
1	25	1800	220	G.E.	KT-512
5	25**	1749	440	Century	8C-364
1	25	1160	440	West.	C8-667C
1	25	900	220	Howell	8CRB-356***
2	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1160	440	West.	C8-644
1	30	870	220	West.	C8-646
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	C8-583C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
2	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-546
1	75	1160	440	West.	C8-662C
1	75	870	220	West.	C8-766A
2	75	865	2300	G.E.	KT-552
1	100	600	220	West.	C
1	100	580	2200	G.E.	IK-15A
2	100	500	2200	West.	C8-930
1	100	495	2200	Al.Ch.	AN
1	100	435	440	Al.Ch.	AR
2	125	400	2300	G.E.	I-17-FR
1	200	580	550‡‡	G.E.	KT-3668
2	300	587	2200	West.	C8-930A
1	400	1165	2200	G.E.	IK-E15B
1	500	1200	440	G.E.	KTP-567
1	700	1800	2300		
			4000	West.	C8-4-39D-12

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ‡‡Reconnectable for 440 volts.

G. E. DYNAMOMETERS

Cradle Type, with control and Dial Scale.
(Write for Complete Specifications.)

Qn.	HP	DC Volts	RPM	Type
1	50-75	250	1650/4000	TLC-20
1	200	250	1200	C

MOTOR GENERATOR SETS
125 and 250 Volts D. C.
(Write for complete Specifications)

KW	Make	RPM	DC Volts	AC Volts
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	380/220‡
10	West.	1750	125	220/440
10	West.	1450	125	220/440†
10	West.	1150	250	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440‡
16	West‡	1750	125	2200/440
20	West.	1750	250	220/440
25	G.E.	1200	125	220/440
30	G.E.	1800	250	220/440
30	Al.Ch.	1750	125	220/440
50	West.	1750	250	220/440
50	G.E.	720	125	220/240
75	G.E.*	1200	125	220/240
100	Columbia*	1200	250	2300/440
150	West.*	1200	250	2300/440

Note: 3KW, 5KW & 7.5kw, 250V Sets Available
**New. *Synch. Motor Driven. ‡50 Cy. †25 Cy.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.

ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED
MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

MOTOR GENERATOR SETS

1—500 KW G.E. Syn. 250 V. 900 RPM.
1—400 KW WEST. Syn. 600 V. 720 RPM
2—300 KW G.E. Syn. 250 V. 1200 RPM
2—250 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW G.E. Syn. 250 V. 1200 RPM
1—100 KW G.E. Ind. 250 V. 1200 RPM

ROTARY CONVERTER

1—500 KW G.E. Syn. 250 V. HCC 1200 RPM
1—150 KW G.E. Syn. 250 V. HCC 1200 RPM

ARMATURES

1—500 KW G.E. 250 V. MPC Gen. 900 RPM
1—300 KW G.E. 600 V. HCC Conv. 1200 RPM

AIR COMPRESSORS

2—4200' I-R type PRE-2, Size 35x20½x24 Direct Connected to 700 HP G.E. Syn. TS Motor 440/600/2300/4000 V.

WALLACE E. KIRK COMPANY
502 Grant Bldg., Pittsburgh 19, Pa.

AIR COMPRESSORS

2—415 CFM actual 110 lbs. pres. ALLIS-CHALMERS Rotor units each direct connected to ALLIS-CHALMERS B.B. Motor 220/440/3/60/690 Rev. Built 1943. Now running.

1—740 CFM 100 lbs. pres. chg. Pn. 2 stage 17" & 10"x12" Belted with intercooler & unloader.

1—1575 CFM 100 lbs. PRE 2 Ing. Rd 22" & 14"x16" dir. con. 265 HP Cr. Wh. 2300/3/60 Syn. motor.

Moorhead Electrical Machinery Co.
367 NOBLESTOWN RD. OAKDALE, PA.

600 KW DIRECT CURRENT GENERAL MOTORS DIESEL SET, Westinghouse Generator 500 Volt, 720 RPM. Electric Start. Unused.

450 HP ENTERPRISE DIESEL ENGINE, Model DSG-6, 6 cyl., 4 cycle, 450 RPM, air start, solid injection. Unused.

Other sizes in stock
from 10 to 1000 KW.

ALJOHN DIESEL CO., INC.
904-10 Pacific St., Brooklyn 16, N. Y.
STerling 3-6515

FOR SALE

MODERN 1000 KW Turbo-Generator

in Excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

NEWMAN & COMPANY, INC.
6101 Tacony St. Philadelphia 24, Pa.

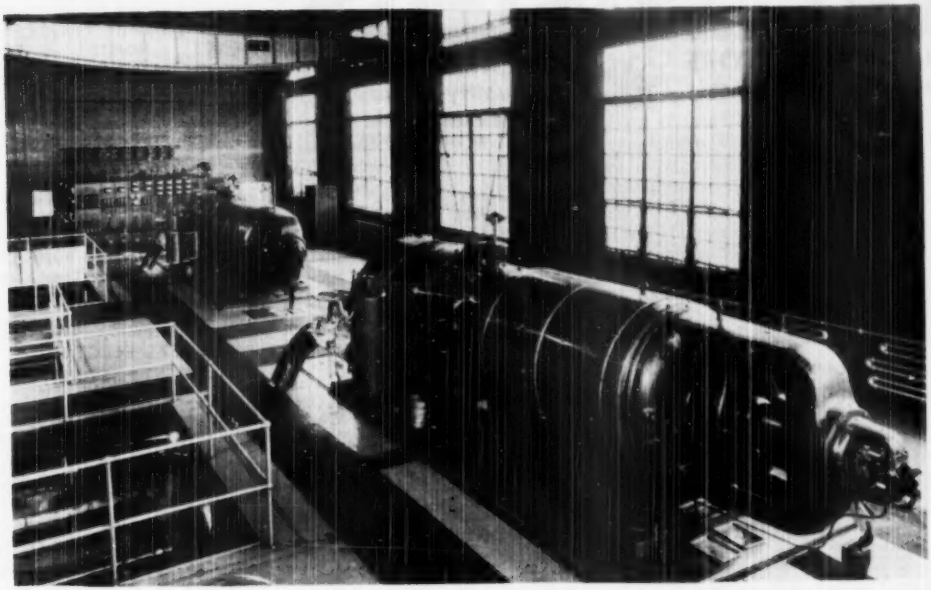
MODERN AIR COMPRESSORS

6040 Ft. INGERSOLL RAND 60 LB. ELECTRIC.
1—3865 & 1—4486 Ft. NEW CHICAGO PNEU. OCE. ELEC. 125 LB. W MOTOR TO SUIT.
3176 Ft. SULLIVAN WN4 ELECTRIC. 125 LB.
1579 Ft. CHGO. PNEU. DIESEL. 125 LB.
1302 Ft. INGERSOLL RAND PRE-2 ELECTRIC. 100 LB.
910 Ft. WORTHINGTON V BELT DRIVE 125 LB. WITH OR WITHOUT MOTOR.
DARIEN, 60 E. 42nd St., New York 17, N.Y.

2500 KW. @ .80, 3125-KVA.

Two (2) GENERAL ELECTRIC TURBO-GENERATORS

VERY HIGH GRADE MACHINES



Above Reproduced Photo Shows These 2-2500-KW., G.E. as They are Today. Photo Taken August 26, 1950, Are Duplicates.

GENERAL SPECIFICATIONS

Turbines

MFR.—General Electric Co.
Capacity—2500-KW.
Type—Curtis, 4-Stage, Condensing
Steam (Initial)—160/225#
Speed—3600-RPM.
Superheat—450-FTT
Serial Nos. 23297; 23299

Generators

MFR.—General Electric Co.
Capacity—2500 KW., 80% 3125-KVA.
Speed—3600-RPM.
Frequency—3/60/2300/4160/6900
Type—ATB-2
Serial Nos. 2005968; 2005971

CONDENSERS

Alberger, 2-pass, Surface Type, 6750-sq. ft., Serials 12508; 12507
Complete with Condensate and Circulating Pumps, Steam Jet Air Ejectors

SWITCHBOARDS

Complete with NBS. Switchboards

EXCITERS

Direct Connected, 25-KW., 125-volt, Complete Exciters

THESE TWO (2) TURBINE-GENERATORS HAVE BEEN EXCEPTIONALLY WELL MAINTAINED and are in Excellent Condition: Will pass the Most Rigid Inspection.
Drawings, Photos, Complete Data Furnished on Request.
Many Other Sizes of Turbines in Our Stock: Send Us Your Specs.

CORRESPONDENCE INVITED

Telephone Wire or Write.

CHARLES WEAVER
Electrical-Mechanical Engineers
41st Floor Penobscot Building
Detroit 26, Michigan.

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OUR SPECIALTIES: Turbo-Generators, Diesel Power, Boilers, All Capacities.
Always Get Weaver's Prices — Are Money Savers.

WAGNER CERTIFIED REBUILT

ELECTRIC MOTORS & GENERATORS

Backed by 44 Years of Quality & Service

M-G SETS

KW	Mfr	Input V	Output V
500	G.E.*	2300/1000 AC	600 DC
500	Gen. Elec.	2300 AC	250 DC
500	Whse.*	2300 AC	250 DC
300	G.E.*	440 AC	275 DC
300	Gen. Elec.	440/25 cy.	275 DC
300	Whse.*	2300/1000 AC	600 DC
200	Ridgeway*	2300 AC	275 DC
200	Ridgeway*	2300/4000 AC	550 DC
200	Gen. Elec.*	220/440 AC	125 DC
200	Reliance*	220/440 AC	250 DC
150	Burke*	230/440 AC	250 AC
105	Century b.b	220/440 AC	70 DC
100	G.E.*	2200 AC	250 DC
75	Gen. Elec. (3)	220/440 AC	125 DC
75	Cr. Wh. b.b. (2)	220/440 AC	250 DC
75	Star* b.b. NEW	220/440 AC	250 DC
65	Whse.	220/440 AC	250 DC
60	Gen. Elec.	220/440 AC	30 DC
50	Whse.	220/440 AC	250 DC
50	Gen. Elec. (2)	220/440 AC	125 DC
40	N.W. conv.	220 AC	230 DC
40	G.E.	220/440 AC	250 DC
35	G.E.	220/440 AC	48 DC
25	Burke	220/440 AC	125 DC

*Syn. motor drive

D. C. MOTORS

HP	Mfr	Type	Volts	Speed
200	Reliance	1970T	230	575/750
150	Cr. Wheeler b.b.	TEFC	250	900
100	Whse.	SK181	230	450/900
100	Gen. Elec.	C	230	575/1000
100	Gen. Elec.	BC36	115	1150
75	Allis Ch.	E-149	230	500
75	Northw'n	K20	230	1750
75	Cr. Wh. NEW b.b.	CMC-HH	230	1150
75	Century NEW	DN	230	850
75	Whse.	SK160	230	850
60	Cr. Wh.	50H	230	700
60	Century NEW	DN	230	1150
60	Century NEW	DN	230	1750
50	Cr. Wheeler	FH	230	750
50	Cr. Wh. b.b.	101H	230	300/1200
40/60	Whse. (2)	SK160	230	500/1000
40	Cr. Wheeler	EH	230	1750
50	Gen. Elec.	R.C. 14	250	850
40	Whse. (3)	SK130	230	950
35/50	Gen. Elec.	CD123	230	675/1150
30	Whse.	SK93	230	1750
25	Whse.	SK150	230	300/1200

- EXPLOSION PROOF MOTORS—
- GEARHEAD MOTORS, AC & DC.
- FREQUENCY CHANGERS.
- CIRCUIT BREAKERS, AC & DC.
- SPEED REDUCERS

D. C. GENERATORS

HP	Mfr	Type	Volts	Speed
300	Gen. Elec. 1 brg.	DMC	275	720
300	Reliance	1070T	250	720
150	Cr. Wheeler b.b	TEFC	250	1200
105	Century b.b.	1500 amp.	70	1200
100	Gen. Elec.	C	250	750
100	Gen. Elec.	DLC 125/250	250	675
75	Cr. Wh. NEW b.b.	HH	250	1450
75	Allis Ch.	H	250	750
75	Gen. Elec.	RC56	125	1200
65	Whse.	SK160	250	1100
50	Gen. Elec.	R.C. 14	250	1200
50	Cr. Wheeler	50H	250	900
40	Whse.	SK	250	1200
25	G.E. b.b.	CDM - 25	1200	

A. C. MOTORS—25 CYCLE

HP	Mfr	Type	Volts	Speed
300	Gen. Elec.	I-M	440	750
150	Whse.	HF	440	500
150	Gen. Elec.	IK-16	440	750
100	Gen. Elec.	I-K	440	500
50	Gen. Elec. Int.	MTC5337	440	750
50	Gen. Elec.	I-K	440	750
50	Gen. Elec.	KT339	440	1500
40	Gen. Elec.	KT343	440	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
300	Gen. Elec.	ATB	600	720
275	G.E. 25 cycle	ATI	480	750
250	Whse.	G	2400/480	600
235	Gen. Elec.	ATB	240/480	600
187	Gen. Elec. (2)	ATB	240/480	900
150	Elec. Machy.	3 brg.	240/480	514
125	Gen. Elec.	ATB	240/480	720
125	Gen. Elec.	ATB	240/480	300
100	El. Machy.	B.B.	2400	900

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	500	G.E. 3 brg.	I-M	450
1—	400	Gen. Elec.	I-M	514
1—	400	Gen. Elec. 2300V.	IM-EB	1800
2—	300	Allis Ch. 2200V.	ANY	720
1—	300	Gen. Elec. 2200V.	I-M	1800
1—	300	G.E. b.b. New	M566	900
1—	250	Allis Ch. 2200V.	ANY	514
1—	200	GE. 2200V.	I-M 17A	450
2—	200	Gen. Elec. 2200V.	I-M-16	600
1—	200	Gen. Elec.	I-M	360
2—	150	Gen. Elec. 2200V.	I-M-16	900
1—	150	G.E. 2200/4000V.	I-M	1200
1—	150	Allis Ch.	ANY	600
1—	150	Gen Elec.	I-M-17	450
1—	125	Gen Elec.	IM-15	720
1—	100	G.E. Vertical	MT553	1200
2—	100	Gen. Elec.	IM-15A	514
1—	100	Northwestern	HW75A	900
1—	100	Gen. Elec.	I-M	720
1—	75	Howell	SR443	1800
1—	75	Gen. Elec.	I-M-E13	1200
2—	75	Gen. Elec.	I-M-14	720
1—	75	Gen. Elec. Int. duty	MTC5342	900
1—	75	Gen Elec.	MT558	600
1—	75	G.E. 2200V	MT556	720
1—	50	Allis Ch.	ANY	900
1—	50	Howell	SR437	1200
1—	50	Gen. Elec. Int.	TTC5013	600
1—	50	Gen. Elec.	I-M	720
1—	40	Gen. Elec. Int.	MTC5526	900
1—	50	Gen. Elec.	MT336	1200
2—	40	Whse.	CW636A	1200
1—	40	Gen. Elec.	MT536	900

A. C. MOTORS—SYNCHRONOUS

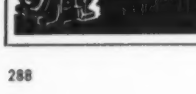
HP	Mfr	Type	Volts	Speed
600	Gen. Elec. (2)	TS	2200	514
300	Whse.	G	2200/440	600
300	Gen. Elec.	ATI	440	720
220	G.E. 3 brg. .8PF	ATI	220/440	600
200	G.E.	TS	220/440	150
200	GE. .8PF	ATI	220/440	900
190	El. Machy.	3 brg	220/440	514
150	Gen. Elec.	ATI	220/440	300
100	American b.b.	YGH	220/440	900
125	El. Machy. (2)	B.B.	2400/4800	900
125	Whse. (2)	late	2200	1800
75	Whse.	8PF late	220/440	1200

A. C. MOTORS—SQUIRREL CAGE

3 Phase 60 Cycle 220 or 440 Volts

Qu	HP	Mfr	Type	Speed
1—	400	Whse. 2200V.	CB	1800
1—	325	Gen Elec.	KT420	400
1—	300	Allis Ch.	AN	720
1—	250	Gen. Elec.	FT549AZ	3600
1—	350	Gen. Elec.	FT549	3600
1—	250	Whse.	CS934A	720
1—	200	Allis. Ch.	AN	1200
1—	200	Whse. b.b. NEW	CS875	1800
1—	150	Gen. Elec. TEFC b.b.	K43338	1200
1—	150	Gen. Elec.	I-K-16	600
1—	150	Reliance b.b. NEW	B6085	1200
2—	150	Gen. Elec.	KF557	1200
1—	150	Gen. Elec. 2200V.	IK-E13A	1800
1—	125	Gen Elec.	K5058	1800
1—	125	Reliance b.b. NEW	C5085	1200
1—	125	Gen. Elec.	I-K-16	450
1—	125	Cont. 2200V. b.b.	SC	1800
2—	125	Rel. TEFC NEW	B6085	1800
2—	125	F.M. 2200V. vertical	UH-16D	1200
2—	100	Allis Ch. 2200V	AR236	1200
1—	100	Rel. TEFC NEW	C5083	1200
1—	100	Gen. Elec. b.b. NEW	K5043	1800
1—	75	Lima b.b.	RS505	1200
1—	75	Reliance b.b. NEW	C5084	900
1—	75	Reliance TEFC NEW	C5084	1200
1—	75	Reliance b.b. NEW	C5085	1800
1—	75	Gen. Elec.	KT529Y	3600
2—	75	Reliance b.b. NEW	C505	1200
1—	60	G. E. hitorq	KG501	1200
1—	60	Gen. Elec.	KT533	720
2—	60	Reliance b.b. NEW	B504	1800
2—	60	Reliance TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
2—	60	Whse. H.T.	CS504	1800
1—	60	Wagner b.b.	RP444	3600
2—	50	Whse.	CS	1200
1—	50	Allis Ch. b.b.	ARK445	1800
1—	50	G.E. NEW b.b. HT	KG405	1800
2—	50	Reliance b.b. NEW	C445	1200
1—	50	Whse. hislip	WL407	900
2—	50	Gen. Elec.	KT552	600
1—	50	Allis Ch. 2200V.	AR445	1800
1—	50	Gen. Elec.	KT546	720
1—	40	Gen. Elec.	KT542	720

QUICK SHIPMENT FROM STOCK — LOW PRICES — FULL GUARANTEE



Arthur Wagner Co.

1435 W. RANDOLPH ST. MO nroe 6-7409 CHICAGO 7, ILLINOIS

CENTRIFUGAL PUMPS

4—Allis Chalmers Electrifugal, Size 6"x5" SSL 20 H.P. 220 or 440 Volt 3/60—1800 RPM, Splash proof. Cap. 1000 GPM, 68' head.

2—Fairbanks Morse, Size 3"—5532 with 15 H.P., 220/440/3/60—1800 RPM, Splash proof motors. Cap. 300 GPM, 100' head.

2—Vacuum, Size 0 Nash Hytor, 50 CFM, 15" hg.

2—Beach-Russ, Size 5 Vacuum, 60 CFM, 26" hg.

HOISTS

1—P & H Size HR-2, 4000#, 32 ft./min., W.M.D. Trolley, 125 ft./min.

1—P & H Zip Lift, 2000#, 220/3/60—18' lift.

MOTORS

1—50 H.P. G.E. Slip ring 220/3/60—900 RPM with drum and grids.

700—¼ H.P. and ⅓ H.P. new capacitor motors, 110/220/3/60, 1800 RPM.

Large stock of pumps, motors and air compressors at all times. Let us have your inquiries.

C-B EQUIPMENT AND PUMP CO.
1440 N. Broadway, St. Louis 6, Mo.
CH 1101 CH 7165

DIESEL ELECTRIC GENERATORS

3—G.E. (NEW) 750 KW, 2400/480 Volts, 3/60, 720 RPM.

2—Westinghouse (NEW) 500 KW, 2400/480/3/60/720.

2—Westinghouse 300 KW, 440V/3/60/1200.

Each direct connected to General Motors Diesel Engine and complete with new, modern Switchboard.

SEE THESE UNITS OPERATED UNDER FULL LOAD IN OUR PLANT.

SUNDFELT EQUIPMENT CO., INC.
220 Hudson Street, Seattle 8, Wash.

FOR SALE
USED BOILERS

3—10,000' American Red Flash heating
1— 30 HP Scotch Marine, 100# hand fired
4— 90 HP locomotive fire box 200#
4—110 HP locomotive fire box 200#
2—150 HP locomotive fire box 150#
1—250 HP B&W water tube 170#
2—150 HP H R T 150#
1—410 HP Heine water tube 200#
1—505 HP Brise water tube 200#
1000 AC 220 Turbine Generator

NATIONAL BOILER & EQUIPMENT CO.
1501 So. Senate Ave., Indianapolis 25, Ind.

STEEL STORAGE TANKS

2—1000 & 2—10,000 Bbl. New Vertical
6—74,000, 55,000 & 37,500 Bbl. Vert.
9—25,000 Gal. Cap. Horizontal
50—10,000 & 3—20,000 Gal. Horizontal
6—10,000 & 12,000 & 16,000 Gal. ⅜" Shell
20—10,000 Gal. Cap. 60 lbs. Press. Test
L. M. STANHOPE, Rosemont, Penna.

FOR SALE

4—Rotary converters—500 KW Westinghouse—60 cycle—600 volts DC—6 phase—833 DC amps—1200 RPM—high serial numbers.

1—200 KW Rotary converter 60-cycle—excellent condition.

FS-7664, POWER
330 W. 42nd St., New York 18, N. Y.

POWER PLANT MACHINERY

STEAM TURBINE GENERATOR UNITS

3 Phase 60 Cycle

6,250 KVA Allis Chalmers condensing, 200# steam pressure, 500° FTT, 2400/4160 volts, with surface condenser.

5,750 KVA New General Electric condensing, 600# steam pressure, 750° FTT. 2400/4160 volts, with or without new surface condenser.

5,000 KVA New General Electric non-condensing extraction, 600# steam pressure, 750° FTT, 125-150# extraction, 25-50# exhaust, 13,800 volts.

5,000 KVA Westinghouse condensing double extraction, 400# steam pressure, 600° FTT, 125# and 20# extraction, 480 volts, with surface condenser.

4,375 KVA General Electric condensing, 200# steam pressure, 500° FTT, 2300 volts, with surface condenser.

3,750 KVA Allis Chalmers condensing, 250# steam pressure, 550° FTT, 480 volts, with jet condenser.

3,125 KVA New General Electric condensing, 600# steam pressure, 750° FTT, 2400/4160 volts, with or without new surface condenser.

2,500 KVA New General Electric condensing extraction, 400/600# steam pressure, 750° FTT, 100-150# extraction, 480/2400/4160 volts, with or without new surface condenser.

2,250 KVA New General Electric condensing, 400# steam pressure, 725° FTT, 2300 volts, with surface condenser.

1,875 KVA General Electric condensing, 200-400# steam pressure, 700° FTT, 2300 volts, with surface condenser.

1,250 KVA General Electric condensing extraction, 200-400# steam pressure 700° FTT, 0-50# extraction, 2300 volts, with surface condenser.

1,250 KVA Westinghouse condensing extraction, 150-250# steam pressure, 600° FTT, 10# extraction, 480 volts, with surface condenser.

625 KVA Westinghouse non-condensing, 150-200# steam pressure, 600° FTT, 25# exhaust, 480 volts.

625 KVA General Electric non-condensing, 400# steam pressure, 700° FTT, 50# exhaust, 2300 volts.

UNIFLOW ENGINE GENERATOR UNITS

3 Phase 60 Cycle

750 KVA Allis Chalmers-Ames vertical, 150# Steam pressure, 5# exhaust, 2400/4160 volts.

625 KVA General Electric-Skinner horizontal, 150# steam pressure, 5# exhaust, 240 volts.

375 KVA General Electric-Skinner horizontal, 150# steam pressure, 5# exhaust, 240/480/2400/4160 volts.

250 KVA General Electric-Ames vertical, 150# steam pressure, 5# exhaust, 480 volts.

188 KVA Electric Machinery-Ames vertical, 150# steam pressure, 5# exhaust, 480 volts.

STEAM BOILERS

200,000 LBS. New Babcock & Wilcox boiler, 600# steam pressure, 850° FTT, oil fired.

60,000 LBS. Combustion Engineering boiler, 450# steam pressure, 600° FTT, with Coxe traveling grate stoker.

50,000 LBS. Springfield boiler, 250# steam pressure, 506° FTT. with Firite stoker.

40,000 LBS. Babcock & Wilcox boiler, 200# steam pressure, 500° FTT, with chain grate stoker.

30,000 LBS. New Combustion Engineering boiler, 450# steam pressure, 550° FTT, with spreader type stoker.

30,000 LBS. New Babcock & Wilcox boiler, package type, 435# steam pressure, 750° FTT, oil or gas fired.

25,000 LBS. Babcock & Wilcox boiler, 250# steam pressure, with Iron Fireman stoker.

DIESEL ENGINE GENERATOR UNITS

3 Phase 60 Cycle

1,225 KVA Fairbanks-Morse, 2400 volts, 300 RPM.

580 KVA Fairbanks-Morse, 2400 volts, 257 RPM.

375 KVA Fairbanks-Morse, 2300 volts, 300 RPM.

250 KVA Electric Machinery-Buckeye, 480 volts, 514 RPM.

SPECIAL
NEW 2500 KVA TURBINE GENERATOR UNITS
3 Phase 120-240 Cycle

3—2500 KVA General Electric Generators, 3 phase, 120/180/240 cycle, 480/2300/4150 volts, direct connected to General Electric Automatic Extraction Condensing Turbines, 400/600# steam pressure, 100/150# extraction pressure.

Write, Wire or Phone for Further Details and Prices

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. **Telephone: MAin 1-9514** **CLEVELAND 14, OHIO**

MOTORS - M.G. SETS - CONTROLS

AT REDUCED PRICES!

NEW SLIP RING

2—New 500 HP, 1200 RPM Elliott, 220/440 V., 3 Ph., 60 Cy., Shaft 4½" dia. x 8" long. (Photo right.) Control Available.

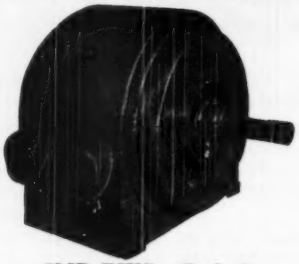
M-G SETS

KW	D.C. Volts	A.C. Volts	Mfg.
500	250	2200	G.E.
400	125/250	2300	Ideal
300	125/250	440/2300	Allis (New)
200	250	2200	Whse.
200	125/250	2200	G.E.
150	250	440	G.E.
125	125/250	2300	G.E.
100	250	220/440	Star (New)
75	250	440	Allis
60	250	220	G.E.
30	250	440	Ideal
7½VS	250	220/440	Rel (New)

Reconditioned and guaranteed

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
900	150	440	G.E.	80%
650	138	2300	Whse.	Engine
500	514	440	E-M	100%
400	900	2300	Whse.	80%
400	720	440	G.E.	80%
350	200	2300	Whse.	100%
300	720	440	Whse.	80%
250	600	4160	E-M	100%
250	514	2300	A-C	90%
150	900	2300	G.E.	100%
150	1200	440	G.E.	80%
75	900	220	E-M	80%



SLIP RING—R & G.

HP	RPM	Volts	Mfg.
1500	514	2300	A-C
800	514	2300	Whse.
700	720	2300	Whse.
500	450	2300	G.E.
450	514	440	Whse.
400	720	2300	G.E.
350	450	2300	Whse.
300	900	440	G.E.
300	600	440	G.E.
200	1200	440	G.E.
200	720	2300	Elliott
150	1200	2300	G.E.
50	720	220	Whse.

NEW SLIP RING CONTROLS

6—250 HP 440/3/60 Fully Magnetic, Reversing, 7 steps acceleration, Allis-Chalmers, with air ckt. brkr. Open or enclosed.

NEW DIRECT CURRENT

230 Volt Drip proof — ball bearing

Qu.	HP	RPM	Mfg.	Frame
3	3	690/2660	G.E.	284
12	5	850/1700	G.E.	CD-66
5	7½	575/1750	G.E.	CD-77
1	10	575/2300	L.A.	4051
3	10	1750	Rel.	T-34
2	30	850/1700	Rel.	T-230
1	75	400/1200	Rel.	T-651
5	250	1750	A-C	149

Reconditioned and guaranteed

230 VOLTS D.C.

HP	RPM	Mfg.	Brg.
250	400/1200	E-D	Ball.
200	400/1200	Rel	Ball.
150	350/1200	Whse.	Ball.
100	475/1350	E-D	Ped.
75	500/1500	C-W	Sleeve
50	350/1050	Whse.	Ball.
40	400/1600	C-W	Ball.
30	400/1200	Rel (TEFC)	Ball.
30	700/1400	Rel (TEFC)	Ball.
25/30	500/1500	C-W	Ball.
25	690	Rel	Ball.
25	400/1600	Rel	Ball.
20	300/1200	Rel	Ball.
15	575/1000	Rel	Ball.
15	700/1350	Rel	Ball.
10	600/1200	Rel (TEFC)	Ball.
10	850	Rel	Ball.
7½	400/1600	Rel	Ball.
7½	600/1800	Rel (TEFC)	Ball.
7½	200/1200	Whse (TEFC)	Ball.
5/7½	400/1600	Whse	Ball.

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WAlbridge 1195

BOSWICK ELECTRIC CO.

P.O. BOX 55 AKRON 9, OHIO

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS

1000 KW to 100 KW

STATIONARY and PORTABLE

AT GREATLY REDUCED PRICES

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ROTARY CONVERTER

330 KW, 250 Volt DC, General Electric type HCC, 3 phase 60 cycle AC with 4160 volt primary transformers. "Excellent Condition."

THE MOTOR REPAIR & MFG. CO.
1557 Hamilton Ave., Cleveland, O.

FOR SALE

1—2500 Ampere, 9 Volt, Munning and Munning Rectifier.

ELECTRIC APPARATUS REPAIR CO.
1400 N. 6th St. Phila 22, Pa.

SPECIAL TRANSFORMERS — YOUR SPECIFICATIONS

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OIL COOLED
AIR COOLED
PHASE CHANGERS

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REBUILT
RECONDITIONED

50,000 & 75,000 Gallon Tanks & Towers
72x16 (2) 150# Code HRT Boilers
250 & 523 HP 200# W. T. Boilers
100 & 500 KW Engine—Generator Sets
170 & 150 KVA Diesels with Generators
250-200-125-100-75 HP Slip Rg. Motors
150-125-100-75-60-50 HP Sq. Cage Motors

H. & P., 6719 Etzel, St. Louis 14, Mo.

Reliably Rebuilt Electrical Equipment

41st YEAR

SPECIALS

1000 KW GENERAL ELECTRIC 250 Volt Synchronous Motor Generator Set, 900 RPM, Generator Type MCF, Motor Type TS.85% T.F. 3 Phase 60 Cycle 2300/4000 Volts.

Factory Built Unit

Rebuilt — 1 YEAR GUARANTEE

PARTIAL LISTINGS ONLY

MOTORS
Squirrel Cage 3 Phase

H.P.	Make	Type	Speed
450	G.E. (vert.)	KF-6338	1180
200	G.E.	KT557	1750
200	Wagner	RP2	1750
200	G.E.	KF-6335	880
150	West.	CS	580
125	Al. Ch. (2)	AR	435
100	Wagner New	XP	1150
100	G.E.	K-544	1175
100	West.	CS	870
100	Al. Ch.		580
75	West.	CS	1750
75	G.E. (3)	K-505	1175
75	G.E.	IK	900
75	G.E. (3)	KT-352	865
75	West.	CS	720
75	G.E.	K-356	690
75	G.E.	KT-558	580
60	F-M	Tot. Enc.	1800
60	West. (2)	CS-607	880
60	Rel. (2)	AA	875
60	G.E.	KT-346	865
50	G.E.	FTR-523	3600
50	Elliott	196	3450
50	West.	CS	1740
50	L.A. (3)	XP	1150
50	West.	XP	1150
50	G.E.	KF-445	1170
50	West.	CS-642C	1160
50	West. (3)	CS	870
50	G.E. (2)	IK	870
50	G.E.	FTR-542	870
50	West.	CS	690

MOTORS
Slip Ring 3 Phase

H.P.	Make	Type	Speed
600	Cr. Wh.	131AQ	507
500	G.E. (2)	IM	450
400	West.	CW	514
225	Wagner	25 cy.	710
200	G.E.	MT559	1150
200	G.E. (2)	IM	1170
150	Wagner	31VRN	900
100	G.E.	MT-553	1165
100	Al. Ch.		690
65	West.	CW	1150
65	G.E.		690
50	West.	HF	850
50	Al. Ch.		690
50	G.E.	MT-536	1150
50	West.	CW	1150
50	G.E.	MT-336	1150
50	L.A.	OGH	870
50	F-M	BV	600
50	Al. Ch.	ARY	575
50	G.E.	IM	490

MOTORS
Synchronous

H.P.	Make	Type	Speed
475	West.		720
400	G.E. (2)	TS-928S	600
300	G.E.	ATI	900
260	G.E.	TS	900
200	Ideal	SMW	257
200	G.E. (2)	TS	1200
150	G.E. (2)	TS	1200
180	G.E.	ATI	900
160	G.E.	TS	1200
145	G.E.	ATI	720
135	West.	G	1200
135	Ideal		1200
100	G.E.	TS	1200
55	El. Mchy.	BRKT	1200

MOTORS
550V. D.C.

H.P.	Make	Type	Speed
765	G.E. (6)	MPC	1045/1380

MOTORS
230V. D.C.

H.P.	Make	Type	Speed
400	A-C		415
185	C-W	CCM152H	233/900
125	G.E.	RC-15	1750
100	Al. Ch.		1150
90/45	G.E.	RF-17	950/475
75	Sprague		1000/1500
75	West. (2)	SK-180	475
75	Cr. Wh.	LT	480/670
75	Cr. Wh.	CMC	375/950
75	West. (3)	SK151	250/1000
60	West. (3)	SK-160	680
50	G.E.	RC-12	1750
50	Diehl		850/1050
45/90	G.E.	RC-17	475/1950
50	West. (3)	SK-160	565
50	G.E.	RF-17	250/1000
50	West.	SK	250/1000
40	West.	SK-103	1750
40	Century	DN-454	1740
40	G.E.	RC-31	1700
40	G.E.	RC-32	1100
40	G.E.	RC-34	750
40	G.E. (2)	CD-1441	400/1500
40	Cr. Wh.	CCM	700
40	Rel.	461T	400/1200
35	West.	SK-120	1150
35	G.E.	RLC	440/800
30	G.E. (8)	CDM-85	2200
30	West.	SK	975
30	Cont.	D-103	850
30	G.E.	RC-33	775
30	West.	SA	500/1500
30	West. (2)	SK-143	575
25	G.E.	RC-15	1750
25	West.	SK-83	1750
25	G.E.	CDM-77	1750
25	F.D.	10S	1500
25	Rel.	92T	1150
25	West.	SA	500/1500
25	West. (2)	SK-130	600
25	G.E.	RF-14	800/1200

MOTORS
115V. D.C.

H.P.	Make	Type	Speed
300	West.	SK	900
100	Cr. Wh.	CMC	900
40	G.E.	CD-115	850
30	West.	S	600
25	G.E. (2)	CD	1800
25	West.	SK-103	1150
25	Cr. Wh.	CCM	750
25	West.	SA	600/1200
15	E.D.	7½S	650/1230
15	Cr. Wh.	CM	650
12½	G.E. (3)	CDM-85	930/1160
12½	G.E.	*CDM-95	930/1160
10	Century	DN-324	1750
10	G.E. (2)	RC	1200
10	Al. Ch.		900
10	E.D.	7½S	425/1700
10	Diehl		230

GENERATORS—A.C.
Driven by D.C. Motors

KVA	Make	D.C. Input	A.C. Output
288	West.	115	450
75	G.E.	230	240
50	Star	115	120
35	G.E.	230	220
31	Ideal	115	440
31	El. Mchy.	230	440
18	G.E.	230	120/240
10	Burke	115	120
7½	Hertner	115	440
5	El. Spec.	115	110
1¼	Al. Ch.	230	110

GENERATORS—A.C.

KW	Make	Type	Speed
216	West.	G	900
180	G.E.	ATB	900
100	G.E.	ATB	360
75	G.E. (2)	ATB	1200
50	F-M	GG	1200
15	G.E.	ASI	1200

Frequency Changers and Generators

Size	Make	Output Frequency
150 KW	G.E.	150 cy.
154 KVA	G.E.	150 cy.
50 KW	G.E.	120 cy.
40 KW	G.E.	100 cy.
30 KW	G.E.	90 cy.
15 KW	G.E.	408 cy.
10 KW	G.E.	200/700 cy.
7½ KW	G.E.	408 cy.
3 KW	G.E.	408 cy.

GENERATORS
600V. M D.C.

KW	Make	Speed
400	G.E. (4)	1200
150	G.E.-RC (2)	1150
100	West.-SK	900
75	West.-SK	1150
60	G.E.	1200
30	Burke	1750
25	Reliance	1150

GENERATORS
250V. D.C. Motor Driven

KW	Make	Speed
1000	G.E.	900
500	West. (2) Rotary	1200
300	Elliott	1200
300	G.E. (3)	720
200	G.E.	1200
150	West.	900
100	Delco	1200
75	G.E.	1200
50	G.E.	1200
40	Rel. (4)	1750
42	ABC (2)	1200
30	G.E.	1200
25	G.E.	1200

GENERATORS
125V. D.C. Motor Driven

KW	Make	Speed
250	G.E.	720
150	Cr. Wh.	1200
150	West.	1150
100	West. (2)	900
100	G.E.	1200
100	El. Mchy.	1200
75	Cr. Wh.	1200
75	Hertner	1150
50	West.	1150
50	Cr. Wh.	1150
50	Sturt.	2800
35	Ideal	1200
30	G.E.	1150
30	L.A.	1450
25	El. Mchy. (2)	1150

GENERATORS
Low Voltage D.C.

Amp.	Make	Voltage
5000	Optimus	6/12
1500	IL-V-W	6/12
125	Hobart (8)	7½
1000	G.E.	15
750	Master	20
1500	Century	24
3000	El. Prod.	24
550	Col.	27
100	G.E.	30
1000	G.E.	33
150	Watton	40
1000	Chandy (3)	40
200	G.E.	42
1500	G.E.	50
1500	Century	60
1500	G.E.	60
1000	G.E.	75

TRANSFORMERS

3—500 KVA Pittsburgh 13200/480.
1—300 KVA, Al. Ch. 3 ph, 41600V. Primary, 230V. Secondary.
1—300 KVA. Pittsburgh. 3 ph, 41600V. Primary, 230V. Secondary.
8—100 KVA West. 3 ph. 440-220 Dry.
2—50 KVA G.E.—11—KF, 2400/4160Y—120/240V. Sec.
4—25 KVA West. 440V. Primary, 110/220V. Sec.
—15 KVA West. 440V. Primary, 110/220V. Sec.
60—Additional Oil and Insulated Dry-type Transformers in Stock, not listed, down to 1 KVA.

STARTERS—A.C.

1—450 H.P. West. magnetic reduced voltage (550 V.) Synch.
2—400 H.P. C-H Bulletin No. 9976, 440V. magnetic reduced voltage Synch.
1—250 H.P. C-H Bulletin No. 9589, 4150V.
1—200 H.P. G.E. CR-7065, 440V. Synch.
3—150 H.P. G.E. CR-7061, 220V. Synch.
2—100 H.P. C-H full voltage Synch.
40—C-H and A-B, 2 and 4 speed magnetic starters.
635—7½ H.P. C-H 440V. magnetic starters.

STARTERS—D.C.

1—600 H.P. 230V. West. magnetic.
150—New 230V. D.C. magnetic starters, from 5 H.P. to 75 H.P., C-H, G.E., etc.
100—New 230V. D.C. manual starters from 1 H.P. to 5 H.P.—G.E. and C-H.
40—New 7½ H.P. 230V. magnetic reversing.
1—300 H.P. West. 230V. magnetic.
Over 250 additional D.C. starters in stock, not listed, all sizes and voltages.

EST. 1910 — L. J. LAND INC. — 41st YEAR

156 GRAND STREET — Phone CAnal 6-6976 — NEW YORK 13, N. Y.

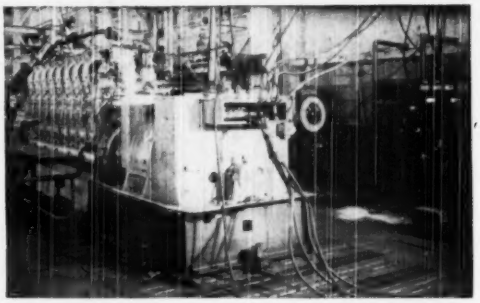
DIESEL POWER

AT 40% TO 60% SAVINGS

EACH ENGINE "REMANUFACTURED"
AND "FULL-LOAD TESTED"
PRIOR TO SHIPMENT

INSPECTION INVITED

ALL EQUIPMENT OFFERED WITH ONE YEAR GUARANTEE



VIEW OF ENGINE TEST STAND FACILITIES AT OUR PLANT IN SAUSALITO (S.F.) CALIF. ALL ENGINE TESTING CONFORMS TO DIESEL MANUFACTURERS' STANDARD METHODS.

A PARTIAL LIST OF OUR INVENTORY

KVA	MAKE	MODEL	HP	RPM	KVA	MAKE	MODEL	HP	RPM
1875	Fairbanks Morse	33E16	2000	300	312.5	Clark	MD-4	375	327
1420	Fairbanks Morse	38D	1600	720	300	Fairbanks Morse	YVA	360	257
1250	General Motors	16-278A	1600	720	250	General Motors	8-268A	350	1200
1000	General Motors	12-278A	1200	720	237	Ingersoll-Rand	S	255	600
937.5	General Motors	12-567	1080	720	200	Buckeye	80	240	600
625	Alco	6-12½x13T	750	600	156	Buckeye	E	190	400
425	Baldwin	VO	510	450	125	General Motors	3-268A	150	1200
400	Buckeye	80	480	600	121	Fairbanks Morse	32E14	140	300
375	Enterprise	DSG-6	450	450	75	General Motors	6-71	90	1200
330	Superior	KNA	396	514	62.5	Int'l Harvester	UD-18	76	1200
312.5	General Motors	8-268A	450	1200	50	General Motors	4-71	60	1200

A. G. SCHOONMAKER COMPANY, INC.

52 CHURCH STREET, NEW YORK 7, N. Y.

SHOPS AND WAREHOUSE: JERSEY CITY, N. J. AND SAUSALITO (S.F.) CALIFORNIA

NORTHERN METAL CO. — MACHINERY at REDUCED PRICES

DIESEL GENERATORS

100 K.W. Allis Chalmers. 1944. 3/60/120/450.
Exciter: 3 K.W. 120 V. D.C.
Diesel Engine: Lorimer. Model FSSS. 150 H.P. 7½"x9½".
5 cylinder, with electric starting motor.

MOTORS

Westinghouse. 1944. Synchronous—Induction.
60 Pole. 3300 S.H.P. 3 Phase. 82.5 Cycles. 2200 Volts.
165 R.P.M. Power Factor 100%.
Exciter: 125 Volts D.C. Load Factor 100%. 1944.

BOILERS

WATER TUBE. Babcock & Wilcox. 1945. 2 Drum. Bent Tube. Economisers. Internal Desuperheater. Superheaters. W.P. 400 P.S.I. Hydrostatic Press. 718 P.S.I. Heating Surfaces: 2441 sq. ft. Superheater 350 sq. ft. Economiser 1620 sq. ft. 3 Todd "Hex Press" Fuel Oil Burners. Diamond Soot Blowers. Auxiliaries available.

NUMEROUS OTHER ITEMS ARE AVAILABLE

MILNOR & BLEIGH STS. • PHILA. 35, PA.

Phone MAyfair 4-1400

TRANSFORMERS — FOR SALE

1 Phase 60 Cycle
Rebuilt and Guaranteed

3—1250 KVA—G.E. 13800 2400
3—1000 KVA—G.E. 13800 480
3—1250 KVA—G.E. 6900 480
3—1000 KVA—G.E. 4800 480
6— 500 KVA—West. 2400 240/480
9— 333 KVA—West. 6900 480
9— 333 KVA—West. 4800 480
9— 333 KVA—West. 2400 480
3— 200 KVA—G.E. 2400 480/240
3— 150 KVA—G.E. 2400 480/240
3— 100 KVA—G.E. 2400 480/240
3— 100 KVA — G.E. 6900/11950Y 460/230
3— 75 KVA—West. 4800/2400 460/230
3— 50 KVA—G.E. 4800/2400 460/230/115
3— 37½ KVA — G.E. 4800/2400 460/230/115

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BUFFALO TRANSFORMER CO.
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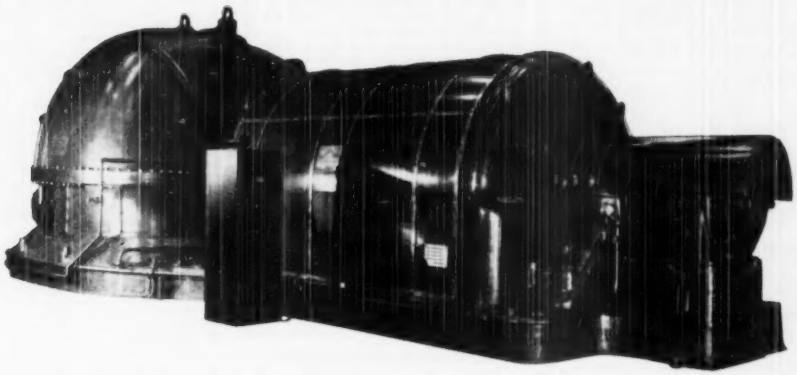
BUFFALO 13, N. Y.

GENERATE YOUR OWN POWER
with "UTILITIES APPROVED" EQUIPMENT



25,000 KVA M—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 200-215 P.S.I.G., 540° total temperature complete with direct connected shaft exciter, switchboard and instruments, a 30,000 sq. ft. 2-pass Westinghouse surface condenser, motor driven and turbine driven pumps and condensing accessories.

EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA G.E. condens., 3-stage, 2300/4000 volts, 200# P.S.I., 600°TT.

3125 KVA G.E. condens., 150#, 550 volts.

2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, two bearing alternating current generator LESS TURBINE.

937½ KVA Allis condensing 250 P.S.I., 700° total temperature, 480/600/2400 volts.

625 KVA G.E. non-condensing 150 P.S.I., 20# back, 480 volt.

375 KVA (4) G.E. condensing 400# pressure, 480/600/2300/4150 volts.

125 KVA G.E. non-condensing, 150-200 P.S.I., 2300 volts.

125 KVA Westghse. non-condensing 150/250 P.S.I. 2400 volts NEW

100 KVA Westghse. non-condensing 125-150# P.S.I. 10# gauge back, 2400 volts.

Direct Current

300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing

150 KW (2) Westinghouse-Worthington, 250 volts, 3-wire, 225-250 P.S.I. condens.

100 K (2) G.E. 125 volt, 200/275 P.S.I. non-condensing

75 KW Allis-Chalmers-Terry, 125 volts, 2400 RPM 150# P.S.I. non-condensing.

75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

60 KW (3) new Westinghouse, 120 volt, 200# P.S.I. condensing.

SYNCHRONOUS MOTORS

3 phase, 60 cycle

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Synchronous (condenser).

900 HP Allis, 2200 volts, 150 RPM.

300 HP G.E., 80% P.F., 2300 volts, 720 RPM.

MOTOR GENERATOR SETS

300 KW Allis, 250 volts DC generator direct connected 430 HP Allis, 3 phase, 60 cycle, 440 volt, 1200 RPM synchronous motor.

OCTOBER BARGAINS

1—4400 sq. ft. Worthington surface condenser.

4—900 KW, 250/375 volt direct current generators connected 1200 HP, 8 cylinders, 720 RPM Fairbanks Diesel Engines.

1—5425 GPM, 70 foot head Centrifugal pump connected 125 HP 60 cycle, 2200 volt, 1750 RPM G.E. motor.

2—1000 GPM, 1270 foot head, 4-stage Morris pumps each direct connected to a 417 HP, 390# P.S.I. non-condensing G.E. turbine.

1—G.E. Bank of Scott connected 2 to 3 phase, 60 cycle transformers, 2500 KVA capacity.

150 KW G.E., 125 volt direct current generator direct connected 225 HP, 3 phase, 60 cycle, 220 volt, 1200 RPM sync!

100 KVA Westghse. 60 cycle, 2400 volt, 900 RPM alternator direct connected 135 HP, 220 volt direct current motor.

62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.

UNAFLOW GENERATOR UNITS

Direct Current

400 KW G.E., 240 volts, 360 RPM generator connected Skinner vertical engine 150#, 10# gauge back.

275 KW Westinghouse, 250 volt generator connected Ames vertical engine.

250 KW (2) G.E., 3-wire, 250 volts generators connected Skinner engines.

150 KW Westghse. 3-wire, 250 volt generator connected Ball Engine.

Alternating Current—3 phase, 60 cycle

750 KVA G.E., 2300/575 volt generator connected Skinner Vertical non-condensing engine, 150-175# P.S.I.

625 KVA 40°C Rise, General Electric, 240 volts generator connected Skinner horizontal non-condensing engine.

500 KVA G.E., 2400/480/240 volts generator connected Ames Vertical Engine.

375 KVA G.E., 2300/440 volts generator connected 22"x24" Skinner Horizontal Engine, 120-150 P.S.I.

175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

UMC UTILITIES MACHINERY CORP.
1965 EAST 6th STREET • CLEVELAND-14, OHIO • Long Distance 422

BREW-WOLTMAN OFFERS

TURBINE UNITS

1—5000 KVA West. Extr. Cond. 60 cy. 2300 V. 385-lb.
1—5000 KVA G.E. Non-C. 60 cy. 13200 V. 600-lb.
1—3125 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lb. 40-lb. BP
1—2500 KVA G.E. Extr. Cond. 60 cy. 480 V. 185-200 lb. steel valve ch.st.
1—2500 KVA West. Non-C. 60 cy. 2300 V. 150-200 lb. 30-lb. BP
2—2250 KVA G.E. Cond. 60 cy. 240-400 lb.
1—1875 KVA Moore Cond. 60 cy. 2300 V. 225-lb.
1—1563 KVA G. E. Extr. Cond. 60 cy. 480 V. 200-lb.
1—1250 KVA Allis Cond. 60 cy. 2300 V. 150-200 lb.
2—1250 KVA Elliott Cond. 60 cy. 480 V. 150-200 lb. 600° Surface Condenser
1—1250 KVA Moore Cond. 60 cy. 2300 V. 225-lb.
1— 625 KVA G.E. Cond. 60 cy. 240 V. 200-lb.
1— 625 KVA Moore Extr. Cond. 60 cy. 2300 V. 225-lb.
1— 25 KW Allis Non-C. DC 125 V. Exciter Dual drive turbine & motor.

DIESEL ENGINE UNITS

2—1400 HP Fair. Morse 2400 V. 60 cy.
3— 700 HP Gen. Motors 2300 V. 60 cy.
3— 650 HP Amer. Loco. 440 V. 60 cy.
1— 600 HP Fair. Morse 2400 V. 60 cy.
1— 400 HP DeLaVergne 2400 V. 60 cy.

STEAM ENGINE UNITS

1—1125 KVA Hamilton Uniflow 2300 V.
1— 312 KVA Skinner Uniflow. 480 V.
1— 312 KVA Ames Uniflow 240 V.
1— 250 KVA Ames Vertical Uniflow 480 V.
1— 250 KVA Ames Uniflow 480 V.
2— 187 KVA Ames Vertical Uniflow 240/480 V.

ROTARIES — 60 CY.

QU.	KW	MFR.	VOLTS D.C.	TRANSF.	RPM
1	3250	G.E.	225/285	13800	360
1	2000	A.C.	600	4150	514
2	1000	West.	600	4150	720
1	1000	G.E.	600	13200	900 Auto.
3	750	West.	600	11000	1200 Auto.
2	500	West.	250	13200	1200

SPECIALS

3—700 HP General Motors Diesel 8 cyl. 4 cy. 360 RPM dir. con. to 485 KW .8 PF 3/60/2300 V. generators.

2—1250 KVA Elliott 3/60/480 V. 3600 RPM generators dir. con. to 150-200 lb. IP 600° TT turbines with dir. con. exciters, surface condensers and pumps.

MERCURY ARC RECTIFIERS

2—6500 KW Ignitron 650 V. DC 13800 Trans.
2—4500 KW Multi Anode 600 V. DC 13800 Trans.
2—3250 KW Ignitron 650 V. DC 13800 Trans.
1—1000 KW Ignitron 650 V. DC 13800 Trans.

MOTOR GENERATOR SETS — 60 CY.

QU.	KW	MFR.	VOLTS D.C.	A.C.	RPM
1	1500	West.	250	4800	514
2	1500	G.E.	600	4150	600
1	1000	G.E.	600	13200	514
1	500	West.	125	2300	720
1	300	West.	250	440	1200
2	250	C.W.	125/250	208	1200
1	200	G.E.	250/275	2300	1200
1	75	Star	240	440	1200
1	75	West.	125	440	1200

SYNCHRONOUS CONDENSERS

QU.	KVA	MFR.	VOLTAGE	RPM
1	2500	G.E.	2400/4160	720
1	2000	West.	2300	720
2	1500	G.E.	2400 4160	900
1	1500	G.E.	4600	900
1	1000	West.	2300	900

SYNCHRONOUS MOTORS — 60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	4350	Cr. Wh.	13800	514
1	800	Ideal	4160/2400	1200
1	600	G.E.	440	360
2	350	G.E.	2300	257
1	300	G.E.	2300	600
1	300	West.	2300	900

FREQUENCY CHANGERS

1—3125 KVA G.E. 25/60 cy. 300 RPM
1—3000 KVA G.E. 60/25 cy. 300 RPM
2—2500 KVA G.E. 25/62½ cy. 750 RPM
1—2450 KVA G.E. 62½/25 cy. 750 RPM
1—1250 KVA G.E. 25/60 cy. 300 RPM
2—1250 KVA West. 25/60 cy. 300 RPM
2—1000 KVA G.E. 25/60 cy. 300 RPM
1— 500 KVA Al. Ch. 25/60 cy. 300 RPM

TRANSFORMERS — 60 CY.

1— 7500 KVA G.E. 138000—41000, 3 ph.
3— 3333 KVA West. 132000—7620/13200 Y
1— 2000 KVA G.E. 69000—13800/23900, 3 ph.
1— 7000/ KVA Al. Ch. 66000—2400, 3 ph.
3— 1000 KVA West. 66000—7200
1— 2500 KVA G.E. 59/73 KV. 5 taps, 3 ph.
3— 100 KVA West. 44000—7200/12470 Y
3— 75 KVA G.E. 44000—2300/4600
3— 8333 KVA West. 43800—13900
4— 6667 KVA G.E. 38100/66000Y—12700/22000 Y/13200
1—18750 KVA A.B.B. 31840—11000, 3 ph.
2—15000 KVA Al. Ch. 33000—12500, 3 ph.
2— 7500 KVA Al. Ch. 33000—13800, 3 ph.
1— 1500 KVA G.E. 33000—2300/4000, 3 ph.
3— 667 KVA G.E. 33000—2300/4600
6— 75 KVA Mol. 33000/16500—2300/6900
6— 50 KVA G.E. 33000—2300
2— 4500 KVA G.E. 27000—2300, 3 ph.
3— 3750 KVA West. 26400/13200—2400
4— 450 KVA Al. Ch. 25410/44000—13200/23000
2— 1000 KVA G.E. 22000/11000—2200, 3 ph.
2— 7500 KVA West. 13800 Rectifier Type
3— 750 KVA West. 13200—440
3— 333 KVA G.E. 13200—2400/4160
3— 200 KVA G.E. 11500—220/110
3— 200 KVA Mol. 11000—2300
3— 167 KVA G.E. 7200/12400—240/480
1— 1500 KVA West. 4000—2300, 3 ph. Auto.
3— 250 KVA Al. Ch. 2300—460
6— 75 KVA G.E. 480—120/240

OIL CIRCUIT BREAKERS

1— 600 A. 73 KV G.E. FHKO-139 Outdoor
1—1200 A. 34.5 KV G.E. FKO-339-1000 Outdoor
4—2000 A. 15 KV G.E. FKO-339-1000 Outdoor
4— 600 A. 15 KV G.E. FHKO-138-BS Outdoor
2— 600 A. 15 KV West. B-28-B-500 Indoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 Church Street — New York City 7, — WOrth 4-1470

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

BOILER UNITS

1—140,000# New Steam Generator 660#, also Super
2—80,000# Boilers, 625#, 825° F.tt., Economizer and Air-heater
2—70,000# 500 psi
2—60,000# B&W 450# superheat
2—30,000# B&W 450# superheat
1—1000 HP Erie City Boiler, 280#
3—600 HP Box Header Straight Tube 200#
6—600 HP B&W Stirling, Super 200#
4—750 ea. Straight tube Edgemoor's 160#
1—45,000# F-W 450# 3 drum, water walled & economizer—superheat
1—1000 HP B&W

TURBO UNITS

1—10,000 KW Turbo-Generator—Cond.
1— 7,500 KW Turbo-Generator—Cond. 660#
1— 7,500 KW Turbo-Generator, Cond.
1— 5,000 KW NEW 400# Cond. Unit complete
1— 5,000 KW Turbo-Generator—Cond.
2— 3,000 KW & 2—2500 KW Cond.
3— 2,000 KW same as above } Also 400# & 600# turbos
2— 1,500 KW same as above
2— 1,250 KW same as above
2— 1,000 KW same as above
1— 500 KW same—Also 750 KW & 300 KW Units

Non-Cond. :—300—500—750—1000—1500—2000

Also smaller Boilers & Fire Tube Boilers
Complete Steam Plants with 2—1250 KW; 2—2500 KW; 2—3000 KW & 7500 KW
Frequency Changers—Transformers! Send us your requirements—We may have it.
Send us your INQUIRIES *for* ALL POWER MACHINERY

CHARLES B. REARICK — 30 CHURCH ST. — NEW YORK 7, N. Y.

COMPRESSORS
VACUUM PUMPS
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Since 1902

ALL MAKES — ONE QUALITY

SAVE 40%-60%

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PORTABLE

60 CFM Chicago, Gas, Starter, Hose Reel, 2 Pneumatics. Rental or Rental Purchase.

American Air Compressor Corp.
Dell Ave. & 47 St., North Bergen, N. J.

-TRANSFORMERS-

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 — CINCINNATI 27, OHIO

asme — BOILERS — Nat'l B'd.

2—404 H.P. Springfield sectional header
5—300 H.P. Combustion Engineering Co.
1—250 H.P. Stirling, Class-H.
3—72" suspended H.R.T. single set

H. P. BREARLEY
34-23 81st STREET JACKSON HEIGHTS, N. Y.

LIQUIDATION SALE — Modern Equipment

DIESEL ENGINES

HP	MAKE	MODEL	RPM	CYCLE
1800	General Motors	16-258S	900	4
1600	General Motors	16-278A	720	2
1600	Fairbanks Morse	38D O/P	720	2
1600	Hamilton	RB89-D.A.	700	2
900	General Motors	12-567 ATL	750	2
900	General Motors	6051 (quads)	650	2
500	Superior	6-cyl.	514	4
215	Superior	VDM B	600	4

DIESEL GENERATOR SETS

DC	1200 KW	525V	750 RPM	General Motors	16-278A	
	650 KW	240V	750 RPM	General Motors	12-567	
	125 KW	120/240	600 RPM	Superior	VDMB	
	100 KW	120/240	1200 RPM	General Motors	3-268A	
	60 KW	120V	1200 RPM	Buda	909	
AC	200 KW	3/60/450	1200 RPM	General Motors	8-268A	rebuilt
	100 KW	3/60/450	1200 RPM	General Motors	3-268A	rebuilt

3—150 KW 3/60460 600 RPM Buckeye model 80 diesel
9—100 KW 3/60/460 600 RPM Worthington BB5 diesel
With Westinghouse generators, exciters, cooling systems, starting equipment, switchboard, silencers, etc. Units practically new.

TURBO-GENERATORS—D.C.

1—375 KW 180/240 V GE Shunt. 1200 non-cond.
5—300 KW 120 V Hendy Compd. 1200 cond.
1—300 KW 240 V GE Compd. 1200 cond.
12—150 KW 120 V Whse. Shunt. 1200 cond.
12— 60 KW 120 V Whse. Stab. Sh. 1800 cond.
1— 25 KW 125 V 3600

MOTORS—DC

1500 HP 525 V DC 600 RPM W'hse.
1362 HP 415 V DC 1200 RPM Elliott
667 HP 375 V DC 1300 RPM Elliott
444 HP 250 V DC 900 RPM Elliott
222 HP 230 V DC 3050 HP W'hse
50 HP 230 V DC 525/1800 W'hse.
15 HP 120 V DC 500 RPM Diehl

GENERATORS—DC

1200 KW 525 V 750 RPM All. Chalm.
1075 KW 375 V 750 RPM Elliott
700 KW 240 V 500/720 Elliott
375 KW 240 V 1200 W'hse.

AIR COMPRESSOR

2000 CFM at 90 psi, 3 stages, driven by 450 HP diesel mfr. Clark Bros.

NEW PUSHBUTTON STARTERS

2000—Line Starters, magnetic, for AC motors, rated 7½ HP at 440V, 5 HP at 230V, 3 HP at 110V, mfd. by Ward Leonard and Westinghouse.
80—Line Starters, 115V DC, 9.5 amps, G.E. (NEW).

HIGH PRESSURE AIR COMPRESSORS
CENTRIFUGES
EVAPORATORS
TRANSFORMERS
SOOT BLOWERS
WINCH TYPE MOTORS

MODERN TURBO GENERATORS AC

1—2000 KW 3 phase 60 cycle 3600 RPM 480/600/2400/4160V type ATB-2 Form HL driven by steam turbine, 410# steam pressure, exhaust 2½" Hg abs., 275 deg. F superheat. General Electric Company. (also 2900 at 1700 V)
2—250 KW G.E. type ATI 3/60/450 1200 RPM condensing.
2—200 KW Westinghse. 3/60/450 1200 RPM condensing (unused).
6—200 KW G.E. type ATB 3/60/450 1200 RPM cond. and non-cond.

GENERATORS—AC

3—2000 KW 3/60/480/600/2400/4160 3600 RPM type ATB-2 Form HL. Mfd. by G.E.

MOTORS—AC

4—6000 HP at 93-1/3 cycle 400 RPM or 3800 HP at 60 cycle 257 RPM—G.E.

ICE PLANTS (New)

2—22 ton capacity, Freon 12, mfd. by Frick.

BOILERS

10—Cleaver-Brooks, 2000# steam pr. hr 35# press.
2—Cyclotherm 3000 pounds steam per hour, 125# press.
1—Express Boilers, modified D type, Foster Wheeler 30,000# steam/hr., 435#.
2—Type "D", water tube, Foster Wheeler, 15000# steam/hr., 275# press.

STEAM TURBINES

All New

1—110 HP 250# steam, 10# each. 1200 RPM Sturtevant
10—58.5 HP, 300-475# steam, 10-15# each. 1225-1600 RPM. Sturtevant

CONDENSERS

(Most are new)

No.	Sq. Ft.	Make	Passes	Tubes	
2	8000	Ch. Wheeler	2	Brass	⅝"
4	2300	Str. Wells	2	Alu-Brass	¾"
4	1050	Conseco	2	Cu Ni	⅝"
30	400	All. Chalm.	2	Brass	⅝"
4	300	Wheeler	2	Cu Ni	⅝"
8	155	Conseco	2	Brass	¾"

AIR EJECTORS

1—Foster Wheeler for 3800 sq. ft. cond.
5—Westinghouse type C-42, for 9300 sq. ft. condenser.
2—Ingersoll Rand 275# press., for 8250 sq. ft. condenser.
2—C. H. Wheeler, type 4H240, for 8600 sq. ft. condenser.

HYDRAULIC PUMPS

Vertical quintuplex pumps, 450 GPM, 1750 psi, 128 RPM, mfr. Aldrich, with 700 HP 3/60/2300 motors.

AXIAL FLOW FANS

16,000 CFM 3" S.P. 3/60/440 Buffalo
12,000 CFM 3" S.P. 3/60/440 Clarage
35,000 CFM 1" S.P. 230V DC Wing

BLOWERS — AIR PUMP

8—Blowers, Roots Connersville, size 16x18, serial No. 14862, capacity 5000 CFM against 6 lb. sq. in. ga. pressure or 3450 CFM when creating 20" Hg vacuum, with 200 HP motors 3/60/2200. Also available: 1 R.C. Blower, size 20x23 with 350 HP motor.
1—Air Pump, Ingersoll Rand, type FB548, 5500 CFM, discharge press. 24.22 abs., intake press. 20.61 abs., with 125 HP motor 3/60/2300.
1—Air Pump, Ingersoll Rand, type FB548, 6690 CFM, discharge press. 20.86 abs., intake press. 17.10 abs., with 150 HP motor 3/60/2200.
1—Blower, Buffalo, size 60, type R, with 150 HP motor 3/60/2200.

WIRE ROPE SLINGS

Dia. from ⅝" to 2½"
Length from 10 ft. to 150 ft.

HOISTS

15—15,000# pull at 78 FPM, 3360# pull at 348 FPM and 2 auxiliary drums. Driven by Chrysler 28.35 H.P. gasoline engines. (NEW).

BOILER FEED PUMPS
FIRE, IRRIGATION AND GENERAL SERVICE PUMPS
HEAT TREATING FURNACES
OXYGEN PRODUCING PLANTS
WELDING ELECTRODES
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MOTORS • GENERATORS • TRANSFORMERS

200 KW M.G. SET

200 KW Westinghouse NEMA Frame Generator 250 V. DC 1200 RPM direct Connected to
300 HP. Westinghouse Synchronous Motor 3/60 220/440 Volts 1200 RPM.
AC & DC Panels—Like new. Ship now.

ANODIZING M.G. SET

33 KW Gen. Elect. Type ER. Form C 60 V. DC. Direct connected to 50 HP. 3/60/440/1800 Gen. Elect. Motor.

MOTORS

60—50—25 CYCLE
In stock—all sizes
Slipring — Squirrel Cage — Synchronous
All types of control equipment.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

DIRECT CURRENT EQUIPMENT

125-250 Volt Motors, Generators and M-G Sets with controls.

SLIPRING MOTOR

100 HP Westinghouse type CW 3 phase, 60 cycle, 220/440 volt 450 RPM.

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle.

ALL ITEMS IN STOCK FOR IMMEDIATE SHIPMENT

NIAGARA TRANSFORMERS

1 Phase — 60 Cycle — New

Stock Shipment on sizes listed. Short delivery on sizes up to 5000 KVA—1 or 3 phase, in voltage ratings to 69 KV. Standard taps. Built to A.I.E.E. —N.E.M.A.—A.S.A. Standards.

LISTING OF TRANSFORMERS

Quantity	KVA	Primary	Secondary
3	15	7200/12470Y	240/480
3	15	2400/4160Y	240/480
3	25	2400/4160Y	120/240
6	25	2400/4160Y	240/480
3	25	7200/12470Y	240/480
3	37½	2400/4160Y	120/240
3	37½	2400/4160Y	240/480
9	50	2400/4160Y	240/480
2	75	2400/4160Y	120/240
6	75	2400/4160Y	240/480
3	100	2400/4160Y	120/240
3	100	2400/4160Y	240/480
3	167	2400/4160Y	240/480
3	167	2400/4160Y	120/240
3	250	2400/4160Y	240/480

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

MOTORS—M.G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS, 3 Ph., 60-Cy

Qu.	HP	Make	Type	Volts	RPM
1	400	G.E.	IK	2300	514
1	400	G.E.	KT-412	2300	450
1	400	G.E.	KT-412	550	450
1	300	Al.Ch.	AR	440	1760
1	250	Whse.	CS	2200	1160
1	250	Whse.	CS	440	1160
1	200	Al.Ch.	AR	220/440	580
1	150	G.E.	1-K	440	720
1	150	Cr.Wh.		440	600
1	125	Whse.	CS-761	440	1750
1	125	Whse.	CS-772	2200	1170
3	125	Whse.	CS-772	440	1170
2	125	Al.Ch.	AR	440	435
2	125	C.W.		440	830
3	100	Whse.	CS-683	440	1750
1	100	Al.Ch.	AR-226	2200	1160
1	100	Al.Ch.	AR-226	440	1160
2	100	G.E.	KT-556	2200	865
5	100	F.M.	H8-591C	440	880
2	100	G.E.	KT-556	550	865
1	100	Al.Ch.	AR	550	690
1	100	F.M.	H-241B	440	450
1	100	Whse.	CS-838	2200	514
1	75	G.E.	1-15-K	220	570
1	75	Al.Ch.	AR	2200	1765
1	75	Al.Ch.	AR	550	1765
1	75	Whse.	CS	440	1750
1	75	G.E.	KF-542	440	1200

1—Unused G.E. Vertical Pump Motor, 300 HP, KF-574, 2200-Volt, 3 phase, 60 cycle, B.B., 580 R.P.M., drip proof.

SYNCHRONOUS MOTORS, 3 Ph., 60-Cy

Qu.	HP	Make	PF	Volts	R.P.M.
1	700	G.E.	80	2300	720
1	450	G.E.	80	440	360
1	300	Whse.	100	440	450
1	268	Al.Ch.	100	2200	900
2	250	Al.Ch.	90	2200	514
1	200	G.E.	100	2300	514
1	200	Whse.	80	440	360
1	150	G.E.	100	2200	900
1	150	G.E.	80	550	450
1	150	Whse.	100	2200	400
3	125	El.Mch.	100	4800	900
1	125	G.E.	80	2200	900
3	100	Whse.	80	440	1800
1	100	Ideal	80	440	900
1	100	Whse.	100	2200	1200
2	100	G.E.	80	440	600

SLIP RING MOTORS—CONSTANT DUTY
3-Phase, 60-Cycle

Qu.	HP	Make	Type	Volts	RPM
1	5000	G.E.	MT	2200	356
1**	2000	G.E.	MT-30	2200	240
1**	1500	Al. Ch.	ANY	2200	250
1**	1200	Cr. Wh.		2200	257
2**	1000	Al. Ch.	ANY	2200	225
1	1000	Whse.	CW	2200	444
1**	800	G.E.	MT-12	6600/2200	590
1	700	G.E.	MT-832	2200	400
1**	600	G.E.	MT-812	2200	719
2	500	G.E.	1-16-M	2300	450
1	500	Whse.	C.W.	2300	575
1	400	G.E.	MT-574	550	585
1	400	G.E.	1-E17-M	2300	875
1**	400	G.E.	I-M	2200	590
1**	400	Al. Ch.	ANY	2200	505
2	400	G.E.	MT-412	2200	440
1	300	G.E.	1-E15-M	2200	1200
1	300	Al. Ch.	ANY	2200	505
1	250	Al. Ch.	ANY	440	440
1	250	Whse.	CW-1106	2200	580
1	250	Whse.	C.W.	550	514
1	200	Al. Ch.	ANY	2200	585
1	150	G.E.	1-E13-M	2200	1750
1	125	Whse.	C.W.-870	2200	900
1	100	Al. Ch.	ANY	440	1160
1	100	F.M.	420-C	440	900
1	80	G.E.	1M	440	860
1	75	G.E.	1.M.	440	695
1	50	G.E.	MT-536	2200	1150

**—Mill type pedestal bearing.
Note: Some of these motors can be furnished as 3-bearing.

TRANSFORMERS—(OIL COOLED)

Qu.	K.V.A.	Make	Type	Ph.	Volt.
2	4500	G.E.	HT	3	27000/13500/2300
3	500	G.E.	H	1	13200/11880/220/440
3	200	Pitts.	OIHC	1	14400/12600/220/440
2	150	G.E.	H	1	19000/9500/550/2300
3	100	Whse.	S8	1	12675/10955/230/460
3	100	G.E.	H-KF	1	4160/120/240
3	75	G.E.	H-KF	1	2400/4160Y/120/240

MOTOR GENERATOR SETS

Qu.	K.W.	Make	R.P.M.	Volts	Volts
2	1500	G.E.	600	600	4160/2400
1	1250	Al. Ch.	720	525	4800/2400
1	600	Al. Ch.	900	250	2200
1	400	Whse.	900	230	4600/2300
1	300	G.E.	720	250/125	2200/440
2	150	C.W.	900	250	2300/440
1	100	Ridgway	1200	275	4600/2300
1	75	Al. Ch.	900	250	2300
1	75	Whse.	1200	125	440
1	75	Whse.	1200	250	2300/440
2	75	Star	1200	230	440/220
1	50	Reliance	1750	250	440/220
(4-unit variable voltage set with 5-K.W. exciter)					
1	50	Reliance	1750	250	440/220
2	35	G.E.	1750	125	440/220

Still available for inspection on its original foundation (1) 1500-KW Westinghouse M-G Set, 250-VDC, 514 R.P.M., comp. interpole, 2150-HP, syn. motor, .80 P.F., 514 R.P.M., 4600 Volt, 3-ph., 60-cy. (will reconnect for 2300-V), with complete DC and AC panels and reduced voltage starting equipment for syn. motor.

DIRECT CURRENT MOTORS

Qu.	H.P.	Make	Type	R.P.M.
1***	2500	G.E.	MCF-14	200/400
4***	1500	Whse.	Encl.	600
2***	1250	Whse.	Mill	300/600
1***	800	Whse.	Encl.	600
1	500	G.E.	MDC	165/330
1	400	Al. Ch.	Mill	400/1200
1	350	G.E.	C.D. 169	1150
**	350	G.E.	MCF-4	200/600
1	325	Whse.	Q M.	450/900
1	200/250	El. Dy.	#22	400/1200
1	200	Whse.	Mill	300/1200
1	180	G.E.	MPC	400
2*	150	Cr.Wh.	83-H	890

Above are all 230-VDC except where marked ***
****Pedestal Bearing 325/600-VDC. Mill Type—T.E.F.C.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET PHILADELPHIA, PENNA.

POWER EQUIPMENT—READY TO SHIP

Q.	HP	Make	RPM	Type
1 New	200	West.	1200	Syn.
1	250	G.E.	1150	I. E. Vert.
1	250	G.E.	1150	(2200 V.)
1	250	Burke	720	(2200 V.) Syn.
1	200	West.	720	CS-954A
1	200	G.E.	860	(2200 V.)
1	200	Al.Ch.	1800	(2200 V.)
1	200	G.E.	1800	T. S. Syn.
1	175	West.	600	C. S.
1	175	West.	1200	Hi Torque
1	150	West.	257	Syn.
1	150	West.	900	(2200 V.) Syn.
1	150	G.E.	900	ATI Syn.
1	150	West.	1200	MS Hi Torque
1	150	West.	1200	CS-951A
2	150	L.Allis	1775	FX
1	125	El.Mh.	164	Syn.
1	125	West.	450	CS
1	150	West.	600	Syn.
6 New	125	West.	1200	Syn.
1	112	West.	1200	Syn.
1	100	PM	760	Syn.
1	100	Al.Ch.	720	
1	100	West.	900	Syn.
1	100	West.	600	Syn.
1	100	El.Mh.	900	Syn.
1	75	Stanley	600	
1	75	Al.Ch.	585	
1	75	L.Allis	1150	Hi Torque
1 New	60	Rell'ce	1200	TEFC RB
1	75	L.Allis	1770	FNC-505
1	75	Master	1750	TEFC
1	60	Al.Ch.	515	
4 New	60	West.	900	Exp. Proof
5 New	60	West.	900	TEFC
1 New	60	Rell'ce	880	TEFC
1	60	G.E.	1800	
1	60	PM	1200	Syn.
1	50	G.E.	1750	KT-256
1 New	50	Rell'ce	720	TEFC
2	50	G.E.	720	KT-546
1	50	Wagner	900	Form Melchel
1 New	50	Rell'ce	900	TEFC
1	50	G.E.	1200	
1	50	West.	1735	CR
1	50	Wagner	1750	TEFC
2 New	50	Rell'ce	1750	TEFC (2200 V.)
2 New	50	G.E.	1750	TEFC (2200 V.)
1 New	50	West.	1750	TEFC
2	40	G.E.	570	KT-546
1 New	30	G.E.	900	Hi Torque
1 New	30	West.	900	Hi Torque
1 New	30	L.Allis	1800/1200	
1	30	G.E.	1750	TEFC
1	25	West.	1800	TEFC
3	25/6.2	Cont'l	1150/575	
1	25	West.	1150	CS-W-405
2 New	25	G.E.	1760	K-264Z

GEAR MOTOR BARGAIN

50 HP G. E. 1755 rpm input 13 rpm output speed 220/440 or 550 v. A.C. 3 ph. 60 cy. splash proof ball bearing.

SPECIAL BARGAINS
Diesel Engine Generator Sets

10—100 kw., 120/240 v. D.C. Delco Generators dir. con. to 150 HP Model GBD-8, 8½x7, 8 cyl., Superior DIESEL Engines, elec. start with engine panels

4—100 KW same as above with 220 or 440 v. NEW A.C. Generators

1—63 kva. 120/208 v. 3 ph. 60 cy. 1800 rpm., driven by Cat. DIESEL m'd on trailer

1—96 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 360 rpm DIESEL

1—75 KW 220/440 v. 3 ph. 60 cy. International GASOLINE

2—75 kva. 220/440 v. 3 ph. 60 cy. Deko Cummins DIESEL

1—62 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 1200 rpm DIESEL

2—37½ kva., 220/440 v. 3 ph. 60 cy. Buda DIESEL

10—NEW 37½ kva., 220/440 v. 3 ph. 60 cy. LoRol Gasoline

1—31.3 kva. 120/208 v. 3 ph. 60 cy. G.E. Gen. driven by LoRol GASOLINE

11—NEW 25 kva. 120/220 v. 1 ph. 60 cy. LoRoi GASOLINE

3—25 KW BRAND NEW Onan 220/440 v. 3 ph. 60 cy. 1800 rpm GASOLINE

1—12½ kva. 120/240 v. 1 ph. 60 cy. 1200 rpm., dir. con. Hercules GASOLINE

2—12 kva. 120/240 v. 1 ph. 60 cy. LoRoi GASOLINE

2—7½ kw. 120/208 3 ph. 60 cy. Buda GAB.

230 V. SERIES WOUND MOTORS

HP	Make	Type	RPM
15	G. E.	CD-1807	800
11	Westg.	K-5	470/630
40	Westg.	K-9	700

SLIP RING MOTORS—3 ph. 60 cy.

HP	Make	Rpm	Volts
600	Ideal	1770	220/440
500	Ideal	1770	220/440
400	Ideal	1770	220/440
400	West.	438	2300
75	G.E.	450	220/440
60	G.E.	570	220/440

A. C. GENERATORS—3 ph. 60 cy.

No.	Kva	Make	Rpm	Volts
6 NEW	100	West.	1200	220/440
10 NEW	37½	West.	900	220/440
3	25	Onan	1800	220/440
11 NEW	25	West.	900	220/440
		(1 ph.)		

MOTOR GENERATOR SETS—
250 V. D.C.
Motors 220/440 volt or 2200 volt

No.	KW	Make	Rpm
2	200	Westinghouse	1200
1	150	Westinghouse	720
1	100	General Electric	900
1	100	Westinghouse	600
1	100	General Electric	1800
1	100	Reliance	540
1	100	Delco	1200

125 V. DC M.G. Sets

1—100 kw. G.E. 125 v. 900 rpm. 220/440 v. 3 ph. 60 cy. AC Syn.

1—75 kw West. 125 v. 1200 rpm. 220/440 v. 3 ph. 60 cy. Syn.

TRANSFORMERS—1 ph. 60 cy.

No.	Kva	Make	Pri.	Sec.
1	500	Standard	2300	575/460/345 230/115
3	500	G.E.	2300	220/440
8	333	Maloney	2300	230/460
3	500	G.E.	2300/4000	230/460
3	150	West.	2400/4160	240/480
3	150	Pgh.	2300	230/460
1	100	Peerless	2700	230/460

ENGINES

NEW 75 HP. P &H. Model 3870 3 cyl. Diesel
Rebuilt 32 HP. Caterpillar Model D-3100 Diesel
NEW 43 HP. International Model U-6 4 cyl.

NEW AXIAL FLOW VENTILATING FANS

20—6000 cfm Sturtevant Bulletin 512389 3" stat. pres. 7 blade dir. con. 5/1.5 HP 1765/1175 rpm 220/440 v. 3 ph. 60 cy. Westg. TEFC Motors.

5—5000 cfm 3.2" stat. pres. Sturtevant with 3 speed 220/440 v. 3 ph. 60 cy. Motors

2—10,000 cfm LADEL dir. con. 3 speed 220/440 v. 3 ph. 60 cy. Motors

1—12000 cfm 2" stat. pres. with 3 speed 220/440 v. 3 phase 60 cy. Motors

2—16000 cfm 3" stat. pres. Buffalo Forge with 3 speed 220/440 v. 3 ph. 60 cy. Motors

1—67000 to 38000 cfm 1" to 9.2" stat. pres. Size 50" dia. 72⅝" l. 3 sets propellers International Eng Co. driven by 100 HP AC Motor

A. C. HOISTS

2—NEW ½ ton Shaw 220/3/60 15' lift 21 fpm

230 V.D.C. MOTORS

2—New 250 HP. Allis Chal. 1750 rpm
1—60 HP. Westinghouse 850 rpm
2—50 HP. Westinghouse 1700 rpm

PLATING SETS

1—1000 amp. 25 v. G. E. driven by 40 HP 230 v. D.C. 1200 rpm mtr. (Like New)

1—50 KW. Chandeysson 20/40 v. sh. wd. dir. con. 75 HP 220/440 v. 3 ph. 60 cy. syn. motor.

WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

DIESEL ENGINES

240 H.P. Fairbanks-Morse style VA, 4 cylinder vertical diesel engines, one 250 KVA alternator and one 260 KVA alternator. These units are complete with 10 KW excitation generators, gasoline motors and tanks for starting, cooling tower and auxiliary equipment, switchboard, governors, complete units are now operating and in good condition.

For Complete specifications and details write:

ALBERS MILLING COMPANY
5045 Wilshire Blvd.
Los Angeles 36, California
Attn: W. G. Fisher

TWO STOKERS, COMPLETE

Detroit Overfeed Rotostoker—double feed. Capacity: 500 boiler H.P. Grate area: 45 sq. ft. Grate dimensions: 6 ft. x 7 ft. 6 in. Stokers complete with forced draft fans. Stoker parts: 4 feed units, 2 drive units, 2 blower fans, 2 wind tunnels, 2 set grates, 2 boiler fronts for mounting feed units.

PURITY BAKERIES
97 E. 12th St. St. Paul 1, Minn.

FOR SALE

WORTHINGTON-WESTINGHOUSE INSTALLATION

COMMERCIALLY UNUSED

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IMMEDIATE DELIVERY

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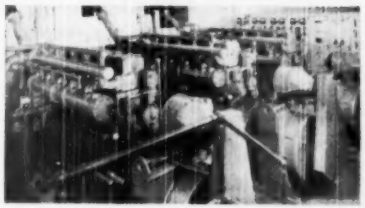


3 Worthington Model BB S—150 HP Diesel Engine Generating Units direct connected to Westinghouse Generators.

Rated 100 KW—125 KVA—3 phase, 60 cycle, 460 Volts, AC Current at 600 RPM.

Suitable for reconnection to 85 KW—3/50/230/400 at 500 RPM.

Complete with all accessories and auxiliaries including evaporative coolers—switchboard—distribution panel.

OWNED & OFFERED BY

KANE-McGUIRE COMPANY

Single units available

1492 East 32nd Street
Brooklyn, New York
PHONE: WHitehall 3-6843

Our 30th Year

HEMPHILL EQUIPMENT PROVES ITS VALUE

Member of The National Industrial Service Association, Inc.

TRANSFORMERS—60 Cycle

Qu.	KVA	MAKE	TYPE	Ph.	VOLTAGES
1	1000	GE	Auto	3/2	4150 x 2406
1	1000	GE	Auto	3	3810Y-2300Y
1	500	Kuhl.	OISC	1	4600 x 2300V
3	400	GE	H	1	6900 x 2250V
1	300	Pitts.	ODSC	1	7600 x 440V
3	300	GE	H	1	2400 x 220/240
1	200	Whse.	Auto	3/2	4150 x 2300
1	200	Pitts.	OISC	1	4000 x 110/220
1	200	GE	Auto	3/2	4150 x 2400
1	150	GE	KS	1	2300 x 230
1	100	Pitts.		1	2750 x 110/220
2	100	Wagner	RCKV	1	240 x 120 /120
2	100	Whse.	SK	1	4400 x 220/440 Taps
2	100	Newark	Dry	3/2	440 x 220

MOTOR GENERATOR SETS
3 Phase, 60 Cycle

Qu.	KW	MAKE	SPEED	DC	AC
1	1000	GE	514	600	2300/4150 Syn.
1	800	GE	900	275	2300/4150 Syn.
1	400	GE	900	275	2300/4150 Syn.
1	300	GE	1200	250	2300 Syn.
2	150	GE	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	CW	1200	125	2300 SC
1	100	CW	1200	125	220/440 SC
1	100	El Mach.	1200	125	4150 Syn.
2	75	GE	1200	125	220/440 SC
6	75	GE	1200	60	220/440 SC
1	50	Ridgeway	1200	550	220/440 SC
1	50	Whse.	900	250	220/440 SC
2	40	El.Mach.	1750	125	440 SC
1	35	Ideal	1200	125	220/440 SC

SLIP RING

1	2500	GE	MT	6600	257
1	500	GE	MT	2200	720
1	300	Whse.	CW	440	600
1	250	Whse.	CW	440	600
1	200	Whse.	CW	440	600
1	150	GE	IM	440	480
1	100	GE	IM	440	400
1	75	GE	MT	220	1200 Vert
1	75	GE	MT	440	900
1	60	GE	MT	220	1750
1	60	GE	MT	440	900
1	50	GE	MT	220	1720
1	50	GE	MT	220	1200
1	50	Whse	CW	220	900
1	50	GE	MT	220	1700
1	50	GE	MT	220	600
1	40	GE	MT	220	1200
1	40	GE	MT	2200	1200

This Seal is *Your Guarantee*

J. L. HEMPHILL & CO.

1604 53rd STREET, NORTH BERGEN, N. J.
PHONE NEW YORK — LONGACRE 5-3227
PHONE NEW JERSEY — UNION 3-2600

6–100 KW WORTHINGTON DIESEL UNITS
ORIGINALLY USED AS 2 — 300 KW POWER PLANTS
Will Sell Individually or As Complete Plants

ENGINES

Worthington Diesel Engines, model 8B-5, 5 cylinders, 8x10½, 600 RPM, rated 150 HP continuous; with Viking safety shutdown and alarm system and Woodward Governors.

GENERATORS

Directly connected to:

Westinghouse, 125 KVA, 100 KW, 460 volts, 3 phase, 60 cycle, Generators with top mounted Exciters 5 KW, 125 volts, D.C.

COOLING SYSTEM

Worthington, 18 EC Evaporative Coolers with motor pumps and heat controlled regulators. Complete with all necessary valves, pumps, and controls.

STARTING EQUIPMENT

Air starting by electric or gasoline driven Compressor.
Air Tanks 47"x18", 400# W.P. Safety valves set at 250#.

SWITCHBOARD

Switchboard has a swinging panel containing:
Synchroscope frequency meter and two volt meters.
A.C. Ammeter.
D.C. Ammeter.
Field discharge switch.
Totalizing hour meter.
Westinghouse silverstat voltage regulator.
Westinghouse air circuit breaker, 3 pole, 200 amp., 600 V.

SILENCERS

Burgess exhaust silencers with cleanouts and flexible exhaust piping with flanges.

FUEL TANKS

Day Fuel Tanks with gauges and electric float switches.
Hand operated fuel transfer pump.

(Units used less than 300 hours.)

3078 CFM I. R. COMPRESSOR
NEW 1945—USED ONLY SIX MONTHS

Type PRE-2 30x18x21, #C46345 & #C46346, 110# discharge pressure, 180 RPM, with intercooler and aftercooler. Direct connected to: 500 HP G. E. synch. motor #6293018, type TS, 3/60/2200 volts, with 7½ KW, 125 V. M.G. Set for excitation, complete with starting panel.

ABOVE UNITS LIKE NEW — BARGAIN PRICE — FOR IMMEDIATE SHIPMENT

Heat and Power Co., inc.

70 PINE STREET | **DIGBY 8-0373** | **NEW YORK 5, N. Y.**

GENERATOR SETS FOR SALE

Cummins Diesel 6 cylinder 100 H.P. electric starter radiator cooled RPM 1200 45 K.W. 2300 volt direct-connected generator exciter attached. Excellent condition, not much wear was used as standby only.

360 K.W. generator unit 2300 volt Chuse Rotary valve steam engine size 23x28 belted exciter 175 RPM. Good buy, see it perform.

Steam generator unit powered by Chuse steam engine equipped with Baker Piston valve direct connected generator 120 K.W. 2300 volt 225 RPM exciter mounted direct on engine shaft. See it perform.

Phone Garfield 4486
or write
JOHN WACHTEL CORPORATION
Box 1217, Indianapolis 6, Indiana

The Stephen A. Douglass Co.

Condensing & Non-cond.:
TURBO-GENERATORS
Efficient, High Grade
Boilers to meet your needs
Diesel Electrics
all with LOW capital cost.
? *On what capacity units shall we quote you* ?
All types Power Equipment also.
630 Fort Washington Ave., N. Y. 33, N. Y.

DIESEL GENERATOR SET!

225 HP Busch Sulzer Model DF, 3 cyl., 4 cycle, solid injection, 360 RPM. Direct erator with direct connected exciter, air connected 150 KW 3/60/2300 volt genfilter, muffler, etc. A modern unit in perfect condition only $4000 f.o.b. St. Louis.

MISSISSIPPI VALLEY EQUIPMENT CO.
507 Locust St. St. Louis 1, Mo.

EXCELLENT POWER UNITS

2—125 KVA Westinghouse AC generators, 440 Volts, 277 RPM. Powered by 2 Bruce Mac Both gas gasoline engines. For immediate sale from Dallas plant changing products.

A A A IRON & METAL CO.
Canton & Hawkins Sts., Dallas 1, Texas

BOILERS

10 to 1000 H. P.
NEW-USED RECONDITIONED
Steam, Gas and Electric Power Equipment
J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

FROM AVAILABLE STOCK

Rebuilt to N.I.S.A. Standards

MOTOR GENERATOR SETS

3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2300/4400
1	1250	G.E.	600	275	2300
1	1000	G.E.	720	250	2300/13200
1	1000	Whse.	900	600	2300/4150
1	1000	Westl.	514	250	4150
1	800	G.E (3U)	1200	120/240	2300
1	750	Al. Ch.	720	250	220/2200
1	750	Whse.	900	250	2300
1	500	G.E.	900	250	440/2300
1	500	G.E.	720	125	2300/4000
2	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	400	G.E.	720	600	2300
1	330	G.E.	900	125	2300/4150
1	300	Whse.	1200	250	1200
1	150	Cr. Wh.	1200	250	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	100	G.E.	1170	125	220
1	75	Cr. Wh.	1170	250	220/440

ROTARY CONVERTERS

60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1—	2000	G.E.	514	600	13800
1—	2000	G.E.	450	600	2300
1—	1000	Whse.	900	600	11000
1—	750	Whse.	900	600	13200

RECTIFIERS

1—	750	G.E.	BHW	575	2300
1—	1000	A.C.	16-613	625	13500
1—	1000*	A.B.B.	GBZ	625	6600/13200

*This unit with full automatic control good for both 25 and 60 cycle.

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	1000	G.E.	Condensing 135/150# IRP 2300/4150 V 3 ph. 60 cy.
2	750	G.E.	Condensing 250/275# IRP 440V. 3 ph. 60 cy. (New 1944)
1	500	Al. Ch.	Non-condensing 125/150# IRP, 5/20# B.P. 480V. 3 ph. 60 cy. with exciter.
1	400	Whse.	Non-condensing 125/150# IRP 5/10# BTU 40/480v. 3 ph. 60 cy.
2	400	G.E.	Condensing, 275# IRP Geared to 1200 RPM. 120/240V. D.C. Generator.
1	300	G.E.	Non-condensing 150/175# IRP 5/15# B.P. 480V. 3 ph. 60 cy.
1	300	Al. Ch.	Condensing 425# IRP Geared to 1200 RPM 120/240V. D. C.
2	200	Cr. Wh.	Condensing 250# IRP GEARED to 1200 RPM—125V. D.C. Gen.
1	200	Whse.	Non-condensing 150# IRP 7# B.P. 240V. 3 ph. 60 cy.

TRANSFORMERS

60 Cycles

Qu.	KVA.	Make	Type	Ph.	Voltages
3	2666	Whse.	OISC	1	6600/11000
1	2500	Al. Ch.	OISC	3	13200 x 2300
3	1000	Pitts.	OISC	1	13200 x 2300
3	1250	G.E.	H	1	6600 x 500
1	1050	G.E.	WCTH	3	1100 / x 445
3	667	Al. Ch.	OISC	1	13200 x 230/460
1	600	Al. Ch.	OISC	3	4000/2300 x 230
2	333	Mahoney	C	1	7620/13200x120/240
3	333	Pitts.	OISC	1	2640 x 2600
6	250	Whse.	OISC	1	11000 x 240
8	200	Whse.	OISC	1	7200 x 240/480

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1750	Whse.		600	525/730
1—1500	Whse.		525	600
1—1200	Whse.		600	425
1—910	Whse	QM-R Brg	230	140/170
1—800/1000	Whse.		450	600/720
1—650	G.E.	MPC	250	115/145
1—600	Al. Ch.	MILL	230	400/500
1—300/400	G.E.	DYNA	250	1325/2500
1—335	Whse.	MQ	250	300/900
1—200/300	G.E.	MPC	230	360/920
1—275	Whse.	QM-600-6	230	425/850
1—250	G.E.	MPC	230	400/500
1—150	G.E.		600	250/750
10—150	Cr. Wh	83H	230	800

FREQUENCY CHANGERS

1—2500	G.E.	25/60 Cycle	2300/4150
1—1000	G.E.	25/60 Cycle	2300/4150
1—500	A.C.	25/60 Cycle	11000/2300V

A. C. MOTORS

3 ph. 60 cycle

SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	TH	2300	257
1—2100	G.E.	ATI	4600	514
2—2000	Whse		2300	120
1—1470	Whse		4600	900
1—1000	Whse		2300	189½
2— 900	Al. Ch.	(New)	2200	150
1— 650	Whse.	G	2200	138
1— 600	Whse.	Syn.	440	360
1— 450	Whse.	Eng.	2200	128.5
2— 350	G.E.	TS	2200	150
1— 320	G.E.	ATI	2300	600
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 300	Al. Ch.		440	600
1— 225	G.E.	ATI 1-Brg	440	900
1— 125	G.E.	ATI	440	450
1— 100	Whse.		550	600

SLIP RING

3— 700	Whse.	CW	2300	900
1— 500	G.E.	IP	650	866
1— 500	G.E.	1M-MH	2200	450
1— 350	G.E.	MT-442Y	2300/4000	253
1— 300	Al. Ch.	S Brg.	2300	600
1— 300	G.E.	1M	440	720
9— 300	Al. Ch.	ANT	2200	706
1— 250	G.E.	M-567-TEFC	440	600
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559S	2200	1750
4— 125	G.E.	MT-566Y	440/2300	435
4— 100	G.E.	MT-566Y	440/2300	435
2— 100	G.E.	1M-16	2200	435
2— 100	G.E.	1M	440	600
3— 100	Al. Ch.	AK	2300	1200

SQUIRREL CAGE

2— 450	Whse.	CB	2300/4150	884
1— 200	G.E.	1K	550	885
1— 200	G.E.	KT-557	440	1800
1— 200/112	G.E.	KP-559BS	440	1170/885
1— 125	Whse.	MR	440	885
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	8585
3— 125	Al. Ch.	ARW	2200	1750
1— 100	Al. Ch.	AR	2200	1170
1— 100	G.E.	1K-Vert.	2300	450
2— 100	G.E.	KT-543	220/440	1750
3— 75	G.E.	KT-547Y	2200	1160

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	3000	Whse		4800	720

RE NU BILT BELYEA MOTORS

BELYEA COMPANY, INC.

43 Howell St., Jersey City 6, N. J.
Phone: Journal Square 2-3334
N. Y. Line: REctor 2-7150

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

1—5000 KW, 13,200 V, 200≠ Cd.
2—4000 KW, 13,800 V, 600≠ NEW N.C.
2—4000 KW, 4160 V, 600≠ NEW Cd.
2—4000 KW, 2300 V, 200≠ Cond.
1—3500 KW, 2300 V, 150≠ Cond.
1—3000 KW, 2300 V, 150≠ Cond.
1—2500 KW, 480 V, 150≠ Cond.
1—2500 KW, 550 V, 250≠ Cond.
2—1800 KW, 2300 V, 400≠ Cond.
1—1000 KW, 2300 V, 200≠ N.C.
1—1000 KW, 2300 V, 165≠ Cond.
2—1000 KW, 480 V, 180≠ Cond.
1— 750 KW, 2300 V, 175≠ Extr.
1— 750 KW, 550 V, 170≠ Extr.
1— 750 KW, 240 V, 170≠ Cond.
1— 500 KW, 2300 V, 175≠ Extr.
1— 150 KW, 2400 V, 130≠ Extr.
1— 150 KW, 2400 V, 130≠ N.C.
1—20,000 KW, 25 cycle

ENGINE GENERATORS

1—500 KW, 2300 V, Unit.
1—335 KW, 2300 V, Unit.
1—168 KW, 220 V, Unit.

BOILERS

2—50,000≠, 300≠
1—30,000≠, 425≠
1—35,000≠, 150≠
2— 750 HP, 200≠
1— 550 HP, 220≠
2— 500 HP, 200≠
3— 500 HP, 400≠
1— 438 HP, 200≠
3— 400 HP, 150≠

DEAERATING HEATER

1—100,000≠ pr. hr

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

THE BUYERS MUST BE SATISFIED—ALWAYS

NO YOU CAN'T BEAT GLOW FOR RELIABLE ELECTRICAL EQUIPMENT

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
750	900	6600	Westgh
400	1200	440	G.E.
300	900	440	GE-I-17
250	1200	440	GE-KTR
250	600	2300	Triumph
225	514	440	GE-I-14
200	600	440	Westgh-CS
150	1800	440	Howell-SC
150	900	440	Allis-Chalmers
150	600	2200	GE
125	3600	220/440	Al.Ch.AN
125	1800	220/440	Al.Ch.AR
125	340	220	Al.Ch.

FREQUENCY CHANGERS

Output KW	Output Volts	Input Volts	Make
2000	2300	2300	GE
1100	250	Any	GE-BCC
100	2300	475	Wtg.
25	220	115	GE
20*	220	220	Delco
15*	220	220	GE
10**	220	550/220	GE

*60/180 cycles—**60/240 cycles

MOTOR GENERATOR SETS

KW	DC Volts	HP	AC Volts	Make
1800	250	2500	4800	GE
750	240	1100	2300	GE
400	250	600	220/440	GE
300	250	443	440	GE-EM
200	250	300	440	GE
150	250	235	440	C-W-EM
100	275	150	440	Wtg.
75	125	115	440	GE
50	125	100	2200	Al.Ch.
32	125	50	440	GE
25	230	40	220	Reliance-GE
20	250	30	220	GE

SYNCHRONOUS MOTORS

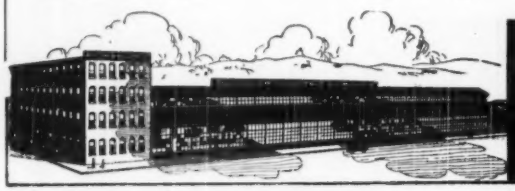
HP	RPM	Volts	Make
3000	720	4800	Wtg.
1015	500	2200	Wtg-25 cycle
500	514	440	GE
435	720	2300	GE type ATI
320	900	2300	GE-ATI
250	1800	2300/4160	GE-ATI
250	225	2200	GE-TS
225	900	4160	GE-ATI
220	600	2300	GE-ATI
175	225	220	GE-Ts (rotor & stator only
160	600	440	GE-ATI
160	164	480	GE-THF (rotor & stator only
150	1800	2200	GE
150	1800	220	GE-ATI, single bearing
150	900	440	Star
150	720	440	Westgh

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
375	1800	2300	Al. Ch.
350	600	440	Al. Ch.
350	514	440	G.E.
300	720	2300	Al. Ch.
250*	600	440	G.E.
250	300	2300	Al. Ch.
200	1800	440	Al. Ch.
200	600	440	Al. Ch.
150	1750	440	GE-MT
150	900	2200	Al. Ch.
150	720	440	Al. Ch.
150	600	440	Al. Ch.
100	1200	550	Westgh.-CW
100	720	440	Al. Ch.
100	400	440	W-E-118
75	720	440	Al. Ch.
60	600	440	Al. Ch.

GLOW ELECTRIC CO., for over 44 years, has done engineered rebuilding of electrical equipment to assure you of quality and dependability.

We invite your inquiries.



GLOW ELECTRIC CO.
927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

Quality SINCE 1906 Wente Motors

WIDE SELECTION UNUSUAL VALUES

THEIR ELECTRICAL CONSTRUCTION HAS BEEN REBUILT... BY EXPERTS

SQUIRREL CAGE
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	50	G.E.	I (2200 V.)	900
2	50	Al. Ch.		900
1	60	G.E.	KT Vert.	1800
4	60	G.E.	KP (2200 V.)	1200
4	60	G.E.	KT547X (2200 V.)	1200
1	60	West.	CS (TEFCBB)	1200
1	75	West.	CS (TEFCBB)	1200
1	60	West.	CS Gearhead	232
1	100	G.E.	KT (2200 V.)	900
3	100	G.E.	K (TEFCBB)	1200
1	110	G.E.	KTP	1200
1	120	G.E.	FT	3600
3	125	Al. Wh.	AB (BB)	450
2	150	Al. Ch.		1750
1	250	G.E.	KF (Vert.)	3600

SLIP RING—SYNCHRONOUS
3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

1	50	Ideal	AV	600
1	50	G.E.	I	700
1	60	Ideal	AVX	1200
1	70	KW G.E.	Ts (.7PF)	1200
1	75	West.	CW	400
1	75	G.E.	I	520
1	75	Fr. Morse	BV (2200 V.)	1800
4	100	G.E.	I-16 (2200 V.)	450
1	100	KW G.E.	ATB (SPF)	900
4	100	G.E.	MT566Y (2200 V.)	450
1	100	G.E.	MT558	900

Qu.	HP	Make	Type	Speed
1	125	Fr. Morse	T (2400 V.) (PF1.0)	900
1	150	West.	CW	450
1	200	West.	CW (I Bear.)	600
1	925	Kva E.M.	(8 PF)	900

D.C.—230 VOLT
(Other voltage as noted)

1	50	West.	SK	250
2	50	Reliance	T	2700
1	50	West.	SK (115 V.)	500
1	60	West.	SK (115 V.)	500/1500
1	75	Diehl	K11	730
2	75-100	Reliance	T1950	300/900
2	75	West.	SK, frame 163	850
1	100	West.	SK, frame 180	1200
1	100	Cr. Wh.	CM	600
1	100	Cr. Wh.	CMC (550 V.)	1200
1	150	West.	SK	400/1200
1	150	West.	SK	350
1	200	Cr. Wh.	CMC	450
2	200	Reliance	T2350	500/900
3	200	G.E.	TLC-74	1350/1600
1	250	West.	SK	1050

M-G SETS

1—45 KW West. 60 V DC—440 V AC 1200 RPM
4—60 KW G.E. 60 V DC—440 V AC 1200 RPM
2—75 KW El. Prod. 220 V DC—440 V AC 1200
1—100 KW West. 250 V DC — 440 V AC 1200
1—100 KW West. 250 V DC — 440 V AC 900
1—100 KW Reliance 250 V DC — 220 V AC 1200
1—100 KW Ridge 275 V DC — 440 V AC 1200
1—150 KW G.E. 275 V DC — 440 V AC 900
ALSO—4000 motors other than listed from 1 HP to 300 HP.

The Wente Electric Co., Hamilton 203 NO. FOURTH ST. Phone 4-8128 Ohio

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Diesel Gasoline and Steam Generators.
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400 KW. used General Electric generator, 220 volt, 3 phase, 60 cycle, direct connected to 600 HP. Nordberg High Efficiency Uniflow engine.

200 KW. used General Electric generator, 220 volt, 3 phase, 60 cycle, direct connected to 300 HP. Nordberg High Efficiency Uniflow engine.

Now installed complete with switch gears, exciters, etc., can be operated for inspection, will sell as one installation, or separate. Immediate delivery.

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- for every Industrial and power application
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GET A-1 PERFORMANCE—SAVE 40 TO 70% IN PRICE

SQUIRREL CAGE MOTORS

3 phase, 60 cycle—220 or 440 volt
(*2200 volt or higher)

H.P.	Make	Type	Speed
750	G.E.	KT	720
500	G.E.	KTP-567	1200
400	*Al. Ch.	ANW	900
300	G.E.	FT-559A	1800
250	Westg.	CS-956A	600
200	Reliance	AA-C60858	1200
200	*G.E.	IE-15-K	1200
150	Westg.	CS-771	1800
150	G.E.	IE-13AK	1200
150	G.E.	IE-13B	1200
150	G.E.	I-15-B	900
150	Westg.	CS-950A	600
125	G.E. TEFC	K-6326B	1200
100	U.S.-Vert.	CFU-994-A	1200
100	Burke	EM-12-5	1200
100	G.E.	K-6333	720
75	Westg. New	CS-505-S	1800
75	Westg.	CS-781	1800
75	G.E.	FTR-543-B	1200
75	G.E.	KT-347	1200
75	G.E.	K-505	1200
75	*G.E. Vert.	CB	900
75	*G.E.	I-10-K	720
75	G.E.	FT-550	720
75	Al. Ch.	AN	720
75	*Triumph	TR-16	514
60	G.E. NEW	K-445	1800
60	G.E. NEW	K-504	1200
60	G.E. NEW	K-504U	1200
60	Al. Ch.	AR-826F	514
50	Al. Ch.	AR-445	1800
50	G.E.	KF-4052	3600
50	G.E.	KT-327	1800
50	Westg.	CS-640	1800
50	G.E. TEFC	K-444	1800
50	G.E.	KT-343	1200
50	Burke	EM-7	900
50	G.E.	KT-346	900
50	G.E.	IK-13	900
40	*Al. Ch.	ARK-403	3600
40	G.E.	KF-4048	3600
40	Westg.	CS-640	1800
40	G.E.	KT-332	1200
40	Al. Ch.	AR-504	900
40	G.E.	KT-336	900
40	G.E.	KT-342	720
30	Howell	HBB-328	3600
30	Westg.	CS-403	1800
30	G.E.	K-444	1200
30	Al. Ch.	AR-204	900
25	Cr. Wh.	118Q	1200
25	Westg.	CS-556A	1200
25	G.E.	KT-332	900
25	Al. Ch	AR-220C	900
20	Westg.	Ch-364	1800
20	G.E.	KT-301S	1200
20	Louis Allis	XL-835	1200
20	G.E.	KT-312	1200
20	Westg.	CS-464-C	1200
20	Westg.	CS-64	900
20	G.E.	KT-326	900
15	Westg.	CS-326	1800
15	G.E.	KT-312	1200
15	G.E.	FRT-302	1200
15	Westg.	CS	900
15	G.E.	KT-322	900
15	G.E.	KT-332	720
10	G.E.	KT-181	3600
10	G.E.	KT-301	1800
10	Howell	SC-350	1800
10	Cr. Wh.	SC-60	1800
10	G.E.	KT-752	1200

SLIP RING MOTORS

3 phase, 60 cycle—220 or 440 volt
(*2200 volt or higher)

H.P.	Make	Type	Speed
2500	*G.E.	MT	257
2000	*G.E.	MT-30	240
1250	*G.E.	M	720
1200	*G.E.	MT-26	277
800	*Westg.	CW	587
650	West.	HE	589
500	Westg.	CW	590
500	Westg.	IE	1000
400	G.E.	CW	450
300	*G.E.	IE15A-4	1000
300	G.E.	IM-17	1200
250	Westg.	CW-32B	900
250	Westg.	CW	600
200	G.E.	IM	600
150	Al. Ch.	ANY	600
100	G.E.NEW	M6333Z	900
100	G.E.NEW	M6334	720
100	Westg.	CW-850C	600
100	G.E.	IM-15A	450
75	G.E.	IM-E-4	1800
75	Westg.	CI-756A	600
75	Cr. Wh.	25Q	600
75	G.E.	IM-14	514
60	*Westg.	CW-762C	900
50	G.E.	IM-11A	1800
00	G.E.	MT-346-B	900
50	Westg.	CW-636A	1200
50	*Al. Ch.	ARY-220BB	1800
50	G.E.	IM-14	429
50	G.E.	MT-343	1200
50	G.E.NEW	M-505	1200
40	Westg.	CW-644C	900
37	G.E.TENVHITC-5812		600
35	G.E.	IM-6	1200
35	Fr.Bros.	UAB-JM12D	1800
30	G.E.NEW	M584-U	800
25	Westg.	CI-572A	900
30	G.E.	MT-332	1200
25	G.E.	IM-11	1200
25	Al.Ch.	ARY-220C	900
20	Al.Ch.	ARY-216D	1200
20	Westg.	CI	900
20	G.E.	IM-12	600
20	Westg.	CW-644C	600
20	G.E.	MT-322	900
20	G.E.	MT-303-4	1800
15	G.E.	MTC-9556	1200
15	G.E.	IM	1200
15	G.E.	IM	900
15	Westg.	CW	900
15	Al.Ch.	ARY216D	900
15	G.E.	ITC-5018	720
10	Al.Ch.	ANY	1200
10	Westg.	MW-306	1200
10	Al.Ch.	ARY-216C	900
7½	G.E.	MT	1200
6½	Rob.Mey.	425A	1200

2 COMPLETE VARI-VOLT DRIVES

M.G. Set, 200 K.W., D.C. gen., Elec. type MPC, 250 volts, 800 amps, 1200 RM, dir conn. to 300 HP syn. motor, Gen. Elec. type TB. 3 ph. 60 cy. 440 volt, .8 PF. 1200 RPM

D.C. Motor, 250 H.P., Gen. Elec. type MPC, 245 volt, 710-575 RPM, with complete starting and control panels.

MOTOR GENERATOR SETS

K.W.	Make	A.C.	D.C.
1000	G.E.	4000	275
500	G.E.	2300	230
500	G.E.	440	250
500	G.E.	4000	1200
450	G.E.	2100	250
200	Cr.Wh.	2100	125
200	G.E.	440	250
150	Al.Ch.	220	125
100	G.E.	440	250
75	Star	440	230
75	G.E.	440	250
60	Al.Ch.	2300	115
60	Fr. Morse	220	125
50	Westg.	220	115
40	Cr. Wh.	220	125
25	G.E.	440	250
20	G.E.	440	250
20	G.E.	440	125
15	Ideal	220	125
10	Cr. Wh.	220	125
10	Ideal	220	125

LOW VOLTAGE—M.G. SETS

Amp.	Make	A.C.	D.C.
1500	Chandyn	440	60
1500	G.E.	2300	80
1000	Chandyn	440	40
333	Columbus	440	45

BALANCING SETS

4—34 K.W., 250 V., 270 A. gen. Bogue, type MC1, 125 V. gen. BB comp'd d c on tab base

2—20 K.W., 250 V., 100 A. gen. Cr. Wh. type 151, 125 V gen 3 sl. brg. Close coupled.

SYN. A.C. MOTORS

3 phase, 60 cycle—220 or 440 volt
(*2300 volt or higher)

H.P.	Make	Type	P.F.	Speed
1000	*Westg.	SC-10358	.8	900
700	*G.E.	ATI	.8	720
450	El.Mach.		1.0	240
320	*Al.Ch.	Dr. Prf	1.0	720
250	*Al.Ch.		1.0	720
200	*Al.Ch.		1.0	360
150	G.E.	ATI	.8	600
125	G.E.	TS-9549	1.0	1200
100	Cr.Wh.	103-S	.8	900
100	G.E.	ATB	.8	900

A.C. GENERATORS

3 phase, 60 cycle—220 or 440 volt
(*2300 volt or higher)

H.P.	Make	Type	P.F.	Speed
1000	*Westg.	801D	.8	900
700	*G.E.	ATI	.8	720
250	*Al.Ch.		.8	720
150	G.E.	ATI	.8	600

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CHICAGO Electric Co.

1320 W. CERMAK RD. • CHICAGO 8, ILL.

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2— 150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6— 100 KVA. 60 CY. 1 PH. 2400-240/120.
5— 75 KVA. 60 CY. 1 PH. 2400-240/120.
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240.

ALSO ALL TYPES OF AIR COOLED AND PHASE CHANGERS.

ATLANTIC TRANSFORMER CO.

5143 N. 2nd St. Philadelphia 20, Pa.

Most all units still on foundation. Many may be seen operating

TURBO. GENERATOR UNITS

3000 KW (2) GE 2300 V. Cond.
1300 KW Wghse. 2300 V. (bleeder)
1250 KW (2) Al. Chal., Cond. 2300 V.
1000 KW. (2) Elliott Condensing-Bleeder 3/60/480 V.
1000 KW GE 440/220 V. (bleeder)
625 KW Al. Chal. 440/220 V. Cond.
625 KW Wghse., Cond. 2300 V.
665 KW Wghse. 600 V. Cond.
500 KW. Wghse. Non-Cond.; 250 V 3 wire, DC.
500 KW. GE 2300 V. Non-Cond.
500 KW. GE 3/60/2400/4160 V—Murray, Cond.
300 KW Wghse. 440/220 V. Cond.
250 KVA. Al. Chal. 240/480 V. Non-Cond.
250 KVA. GE 3-60-600 V. Non-Cond.
ALSO TURBO UNITS; NON-CONDENSING & CONDENSING; from 50 KW. to 2500 KW.

BOILERS

540 HP. Keeler, Heine type 250#
509 HP. (3) B&W Sterling 450#
352 HP. Keeler, cross drum 250#
323 HP Springfield cr. drm. 200#
400 HP. Erie City Heine type 200#
285 HP. B&W 3 drum, type H 250#
250 HP (2) B&W 3 drum type, Type H 160#

STEAM ENGINE SETS A.C.
440/220 Volts

825 KVA GE-Hamilton corliss
625 KVA El. Mchy.—Skinner, Unif.
500 KVA GE-Skinner Uniflow
450 KVA GE-Chuse 4 V.
312 KVA GE-Chuse 4 V.
312 KVA (2) GE-Skinner Uniflow
219 KVA GE—Ames Unif.
187 KVA Wghse.-Ames Uniflow, Vertical
62 KVA GE-Ames Uniflow

DIESEL UNITS A.C.
440/220 Volts

500 KVA Fairbanks Morse Model 33
280 KW GE 250 V. d.c.—General Motors
250 KVA (2) GE-Buckeye 8 cyl.
109 KVA GE-Superior 3 cyl.
106 KVA GE-Murphy 6 cyl., *Portable*
100 KVA GE-Buckeye 5 cyl.
90 KVA Fairbanks Model 32
75 KVA (2) General Motors; *Portable*
225 HP. Buckeye 6 cyl. diesel engine only
ALL SIZES UP TO 1250 KVA

COMPRESSORS

850 CFM (2) 110 lbs., Chicago Pneumatic, *diesel driven*
ALSO ALL SIZES 150 CFM to 1000 CFM.

PUMPS (Motor & Turbine Driven)

From 200 to 2500 GPM; from 200 to 2500' hds.
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Above listed units are only a few of our "SPECIALS". Advise your plant requirements.

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ATLAS IMPERIAL DIESEL FOR SALE

275-HP., 300-RPM., Atlas Imperial Diesel Engine, with Elliott 219-KVA., 3/60/2400-volt Generator. Limited service, Excellent Condition: A Complete Unit. Very Low Price.

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Detroit 26, Michigan

Also in Stock Fairbanks-Morse Diesel 1600-HP., with NEW Elliott 1250-KVA., GENERATOR SETS. ALSO Turbine-Generators and Boilers, Any Capacity. WRITE US.

BOILERS
SAVE 50% PLUS

3 ea. Kewanee #587, 125# WP, all gas controls and fittings, built 1942.

2 ea. Kewanee #590, 125# WP, with boiler trim built 1940.

2 ea. Hedges-Walsh-Widener Water Tube Boilers, Cross Drum, 260# WP, 3604 HS, built 1934. Integral furnace. Not necessary to dismantle to remove. Save over 65% on reinstallation cost.

We have a large inventory of LOW PRESSURE STEEL AND CAST IRON BOILERS. Write us about your requirements, save over 50%.

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SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
600	2200	G.E.	1800
500	2200	G.E.	450
450	440/220	Whse.	514
300	440	Whse.	3600
250	440/220	Whse.	600
200	440	G.E.	450
150	4000/2300	G.E.	3600
150	440/220	Whse.	600
150	440/220	Whse. (3)	1800
150	440/220	G.E.	720
125	4000/2300	G.E.	3600
100	440/220	G.E.	600
100 (2)	440/220	Whse.	900
100	2300/550	G.E.	1800
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	1800

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Syn.	900
240	2300/440	G.E.	ATI	720
200	440/220	G.E.	TS	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

GENERATOR SETS

2—unused 25 kva, 120/280 v., 3 ph., 1200 rpm, generator dir. conn. to Waukesha 6 cyl. gas engine

CIRCUIT BREAKERS

2—2000 amp., GG E, 3 pole, 600 v., air
2—1000 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	PT	3600
500	2200	Cr. Wh.	SC	1800
350	2300	G.E.	KT	1200
300	2200	G.E.	PT	3600
300	2300	G.E.	KT	1800
250	2200/440	L. Allis	OGS	1200
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	KF	720
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IK	450
150	440/220	Whse.	CS	900
150	440/220	G.E.	IK	450
100	2300/550	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
150	440/220	Whse.	CS (NEW)	900
100	2200/440	G.E.	K	1200

A. C. GENERATORS

1—320 kva, 600 rpm, 2300/440/220 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—325 kva, 600 rpm, 220/440 v., G.E.
1—325 kva, 720 rpm, 2300/440 v., G.E.
1—150 kva, 900 rpm, 480/240 v., G.E.
2— 75 kva, 1800 rpm, 480/240 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
350	230 (3)	G.E.	CD	1150
250	230 (3 new)	Cr. Wh.	CMC	1000
150	230	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

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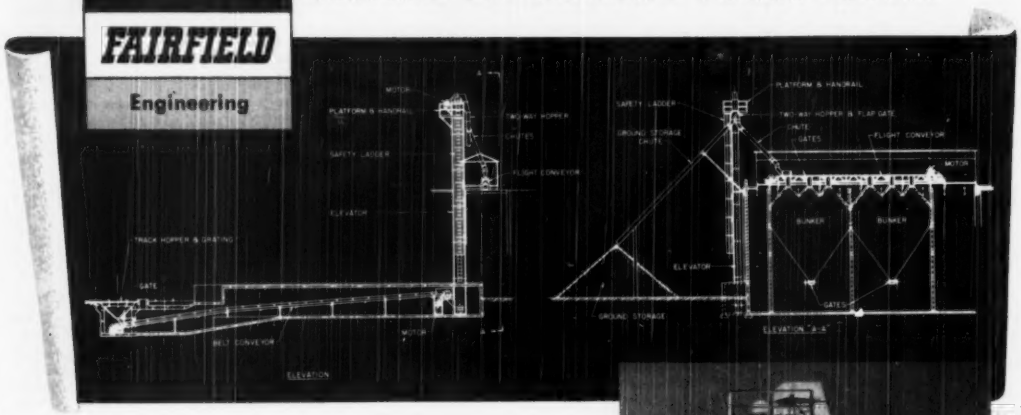

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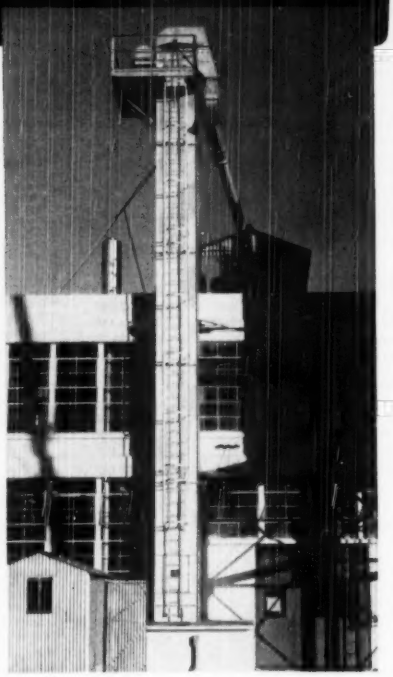

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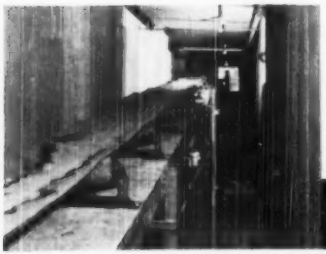

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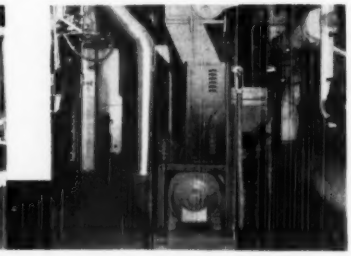

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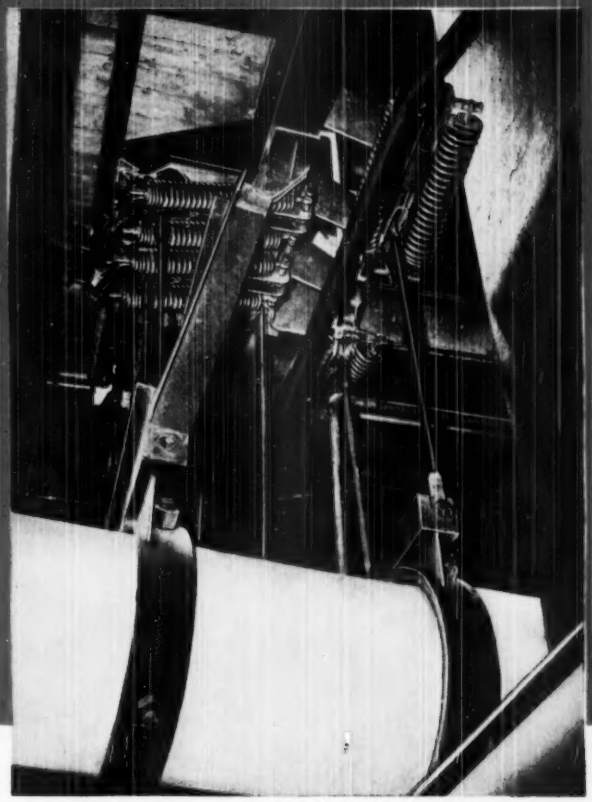

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